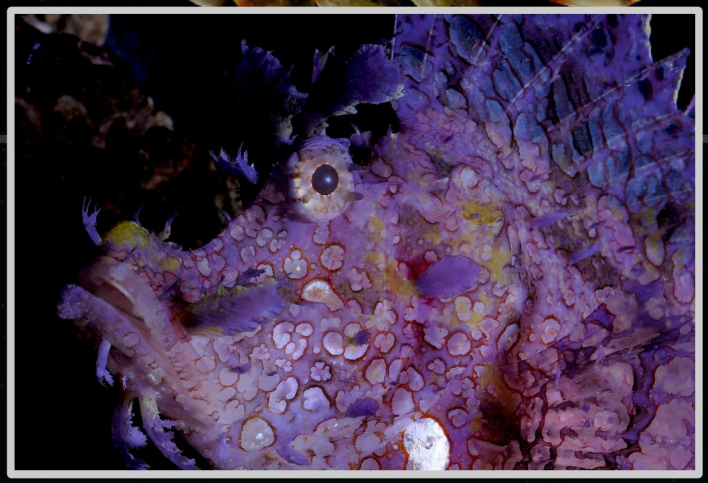
July 2008
Volume VII, Issue VII
ISSN 1931-6895

A Reefs.org Publication

# Advanced Aquarist's Online Magazine



**Halides Aging Over Time**
**Coral Spawning in Hawai'i**
**Kill-a-Watt Electricity Meter**
**Online Photography Course**

*photographs by Chris Hudson*

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Back issues are available for reading and download at
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### Publisher

Pomacanthus Publications, Inc.

### Publication Information

**Advanced Aquarist's Online Magazine** (ISSN 1931-6895) is published monthly online by Pomacanthus Publications, Inc. A central goal of this publication is to promote exchange between the scientific community and amateur aquarists, for the benefit of both disciplines and the environment. To achieve our combined goals of greater understanding of the natural world and honing our husbandry skills we will rely heavily on science and scientists. Advanced Aquarist's Online Magazine will always emphasize protection and understanding of the natural environment.



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ADVANCED AQUARIST'S ONLINE MAGAZINE


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EDITORIAL

# July 2008 - Warning: An Electrical Fire

## By Terry Siegel

*If no one were home the house could well have burnt down.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Editorial, Electricity, Emergency, Terry Siegel, Fire
Link to original article: http://www.advancedaquarist.com/2008/7/aaeditorial

After some 60-years keeping aquariums I'm quite familiar with Murphy's law - what will go wrong, will, and at the most inconvenient time - and that I have corals now for close to 30-years attest to the fact that have had some success at anticipating what can go wrong: backup systems, generators, etc. In the long run however, Murphy will always find ways to get you with something the aquarist never anticipated. Two weeks ago when I was visiting friends in Cleveland I got a phone call around noon from my son saying, "Dad I have bad news: the house is on fire. I'm across the street and there are 6 fire trucks and the fireman are in the basement where the reef tank is." Fortunately, my son was home.

After the fireman left I asked my son, if possible, to try to get the main circulation pump running by using an extension card. He was able to do this, if he hadn't the entire reef tank's animals would have died of oxygen depletion. It was touch and go because two surgeon fish did die. Everything else connected to the system was shut down.

All this took place around noon, and I was able to get a plane back to Portland, Maine from Cleveland, OH. I arrived at about 1:30AM the next day. Everything in the basement was covered with acrid black ash, with plenty of ash in the water. There were broken fluorescent tubes in the refugium. After a close inspection I discovered that a 4-foot fixture, with a plastic housing, had melted and fallen into my refugium, which was connected to the system. There even were broken tubes lying on the bottom of the refugium. The skimmers were not running and had been knocked over by the firemen. All of the fish were hiding and the corals were slimmed up. The question for me now was what to do.

The first thing I did was to dump about 2 lbs of carbon into the system, after that I got both skimmers working - together they process about 3000-gallons/hour. Now it was about 3AM, and some of the fish started to come out of hiding. While I was doing all of this I felt that the situation was hopeless - how could the animals not be poisoned by burn plastic and toxic metal from the burnt fixture. Around 4AM I took a break and looked in the mirror, and discovered that I looked like someone who worked in a coal mine, but was somewhat encouraged because the fish and corals were actually looking better. By noon of the next day, life in the reef tank appeared almost normal.

The last thing I was able to do was to change 200-gallons of water. I always try to keep that much new saltwater on hand. It is now 2-weeks since the fire, and much to my amazement I only lost the two surgeonfish, all of the corals survived. It took 5 people sent by the insurance company over a week to clean up the mess.

A few days ago the Insurance company sent down an expert to try to ascertain how the fire started. He carefully examined the burnt plastic, especially the fluorescent fixture, which by now was almost unrecognizable. He eventually came to the conclusion that one of the ballasts either shorted or overheated and went on fire. Something he noticed also was that the filtration room was extremely humid - it was very humid, hazy, and hot in Portland at the time if the incident. In fact, the walls and floor of the filtration room were wet, and there was even drops of water on some of the wiring. Whether this excessive moisture shorted the ballast, or it overheated was not possible to ascertain.

I'm still not sure how to handle this potential danger - a dehumidifier, air conditioner, different wiring or circuit breakers. Maybe some of our readers have suggestions. One thing is all too clear: this is a potentially dangerous matter. If no one were home the house could well have burnt down.

*This is a picture of the floor joists directly above where the fire started.*

FEATURE ARTICLE

# Metal Halide Lamps - Aging Over Time: XM, EVC and Giesmann Coral 400W Mogul Lamps

By Sanjay Joshi

*The study presented some very interesting data on the life of metal halide lamps. It reinforced the view that the spectral qualities change over time resulting in the change of the CCT of the lamps to lower values.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Bulbs, Equipment, Feature Article, Giesemann, Halide, Halides, Lighting, Sanjay Joshi, XM
Link to original article: http://www.advancedaquarist.com/2008/7/aafeature1

In my earlier articles [1,2], I evaluated data on used metal halide (MH) lamps in an effort to get a better understanding of how lamps age over time, with an intent to help the aquarists answer the question - How often should metal halide lamps be changed ? and getting a sense of what changes occur in light output of MH lamps over time. At that time, due to the difficulties of obtaining the data on the same lamp at various points in its life, getting a large enough sample, the length of time such a study would take among other reasons, used lamps sent in by several aquarists were tested, and spectral data was collected on these lamps. This provided some interesting insight in how lamps age, and the data collected established 2 two important finding - a) the spectrum of the lamp shifts downward over time, b) the blue portions of the spectrum deteriorate faster than the yellow and red portions of the spectrum. The drop in spectral output at each wavelength results in the reduction of the photosynthetic available radiation (PAR) measured as Photosynthetic Photon Flux Density (PPFD) in units of micromoles/$m^2$/sec, and the differential changes in spectral output caused by output of blue portions dropping more than the yellow and red results in the change in the correlated color temperature (CCT) of lamps towards lower numbers.

Not knowing the initial spectral distribution of each lamp was a limitation of the earlier study. Over the last few years, I have been collecting long term data on several lamps in use over my aquarium and the aquarium at Penn State University. The initial goal was to track the spectral data of multiple lamps of the same brand, over several equally spaced time intervals. However, this was easier planned than executed. Due to the long term nature of this project, the time conflicts, availability of instrument, loss of data made it difficult to execute the experiment as initially planned. However, I was able to sample enough data points to provide meaningful data. This article presents the results from this study over several years with 3 different brands of lamps. Table 1 below provides the data on the lamps.

Table 1: Lamps and Ballasts used in the Study

| Lamp | # of Lamps | Ballast Used |
|---|---|---|
| 400W XM 10000K | 4 | Magnetic (M59) |
| 400W EVC 10000K | 4 | Magnetic (M59) |
| 400W GIESMANN CORAL | 3 | Electronic - ICECAP |

## XM Mogul 400W 10000K

Four new XM 400W lamps were purchased from Hellolights.com and installed on the Penn State Aquarium, in the typical manner that most aquarists replace lamps. New lamps, straight from the box on to the lighting fixtures over the aquarium. The lamps were operated by standard magnetic (ANSI M59) ballasts, and lit for 12 hours/day. Before using the lamps, the spectral output was measured, and the data collected is shown in table 2, and the spectral distribution is shown in figure 1.

It is interesting to note, that there is agreement in output between the 4 lamps. Some variations are always to be expected with metal halide lamps, but the differences in this case are within 10%. Another interesting point is to note that the PPFD values that are higher also show an increased use of power consumed.

Table 2: Performance Data for 4 New (0 hrs) XM 400W 10000K Lamps

| Lamp | Ballast | Power | Voltage | Amps | PPFD | CCT | Efficiency |
|---|---|---|---|---|---|---|---|
| XM 400W Lamp #1 0 hrs | M59 | 467 | 119.9 | 4.13 | 208.4 | 11614 | 0.446 |
| XM 400W Lamp #2 0 hrs | M59 | 492 | 119.6 | 4.36 | 224.4 | 10142 | 0.456 |
| XM 400W Lamp #3 0 hrs | M59 | 462 | 119.9 | 4.12 | 202.3 | 10661 | 0.437 |
| XM 400W Lamp #4 0 hrs | M59 | 488 | 120.1 | 4.3 | 218.3 | 11347 | 0.447 |

The initial plan for these lamps, was to measure the output when they were put into use and then measure the final output when the lamps were replaced. Based on my past experiences with metal halide lamps, the plan was to replace these at 15 months of use. During the course of the use of these lamps, lamp #3 had a catastrophic failure of the outer envelope within the first few weeks of use. Lamp #4, failed to start after a few months of use. So I was left with just two working lamps.

These two lamps were removed from service at 17 months of use. The performance data for these lamps is shown in table 3, and the spectral plots are shown in figures 2 and 3.

The data showed some surprising information. The output PPFD of the lamps showed a slight increase in one of the lamps, while the other stayed almost the same. If one were to use a quantum meter to measure the output to determine if the lamp should be changed, it would show little change in output even after 17 months of use. The spectral plot shows where the changes occurred over time, and as expected there is a drop in the blue spectral region, but there was an increase in the spectral range from green to the reds, which made up for the lost output in the blue region. This also clearly shows in the drop in color temperature from the 10000-11000K range when new to 6000-7000K range after 17 months of use. Further analysis of the data showed that while there was little drop in the PPFD, there was a significant increase in the power being consumed by the used lamps. The power consumption increased between 60-70 watts. As observed with MH lamps the output tends to increase with increase in power consumption. From a visual perspective, there was very little change in most of the corals' color or

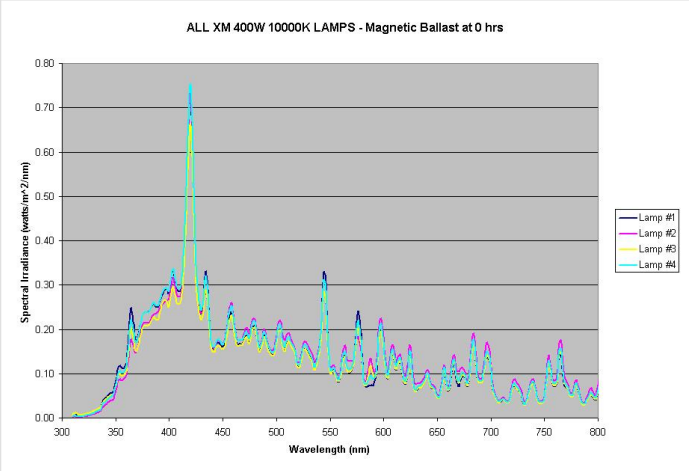


*Figure 1. All XM 400W 10000K Lamps on Magnetic Ballasts at 0 hrs of use*

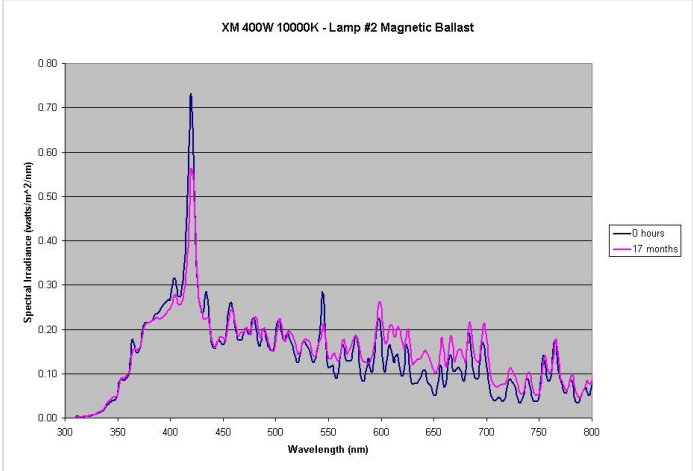


*Figure 3: Spectral Plot for Lamp #2 at 0hr and after 17 months of use*

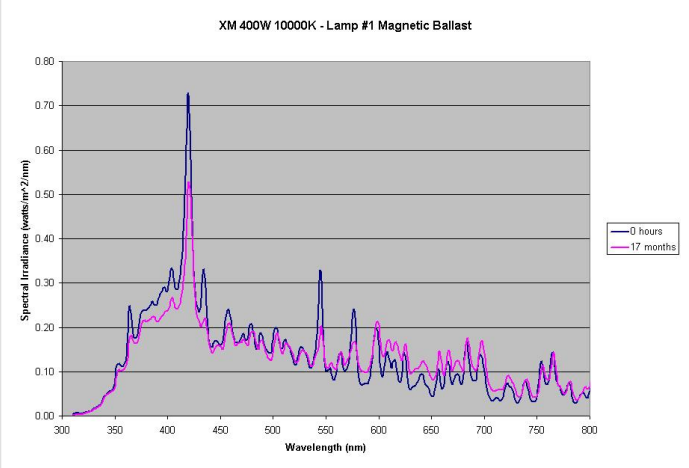


*Figure 2: Spectral Plot for Lamp #1 at 0hr and after 17 months of use*

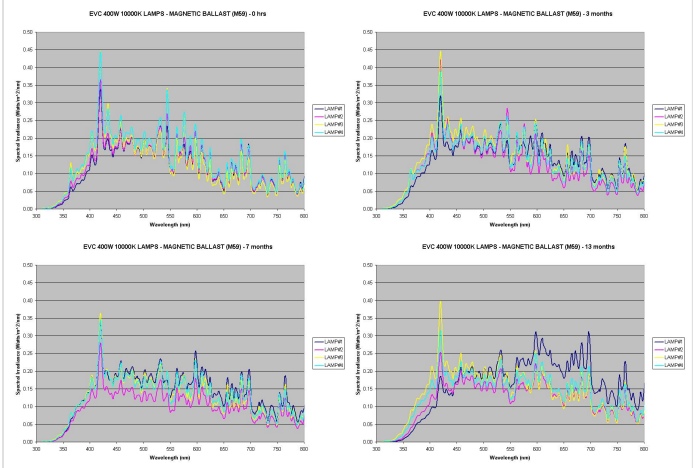

*Figure 4: Spectral plots of the 4 EVC lamps over time*

Table 3: Performance Data for the 2 remaining XM 400W 10000K lamps after 17 months of use

| Lamp | Ballast | Power | Voltage | Amps | PPFD | CCT | Efficiency |
|---|---|---|---|---|---|---|---|
| XM 400W Lamp #1 17m | M59 | 533 | 122.4 | 4.58 | 211 | 7518 | 0.395 |
| XM 400W Lamp #2 17m | M59 | 570 | 121.3 | 4.92 | 250 | 6853 | 0.438 |

visual look of the tank. The blue color of the corals did fade somewhat.

## EVC Mogul 400W 10000K

Four EVC 400W 10000K lamps were purchased and installed on the Penn State Aquarium. The lamps were used for 12hrs/day for 13 months. Table 4 shows all the data collected over the life of these lamps. Figures 4 and 5 show the spectral plots of the lamps at various points in the life of the lamps.

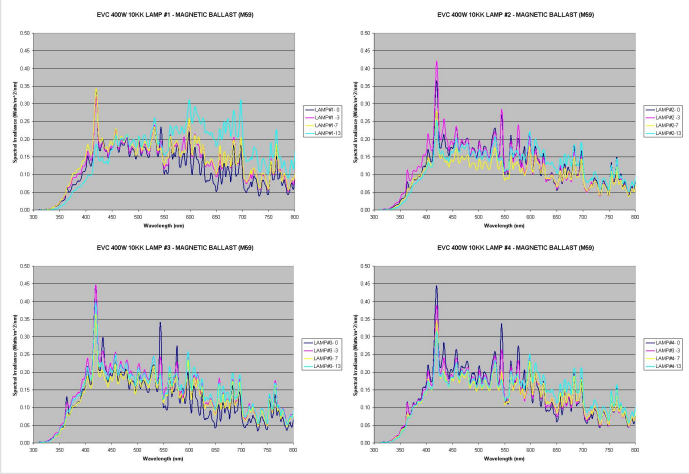
EVC 400W 10KK LAMP #1 - MAGNETIC BALLAST (M59)
EVC 400W 10KK LAMP #2 - MAGNETIC BALLAST (M59)
EVC 400W 10KK LAMP #3 - MAGNETIC BALLAST (M59)
EVC 400W 10KK LAMP #4 - MAGNETIC BALLAST (M59)

*Figure 5: Spectral plots of the 4 EVC lamps - by lamp*

In comparison to the XM 400W 10000K lamps, the EVC lamps showed a larger spectral variation at 0 hrs. Overtime this spectral variation persisted. Interestingly once again, these lamps also showed an increase in output when measured at 13 months, with one lamp showing a much larger increase brought about by the large amount of increase in output over the yellow and red spectral ranges, and a corresponding increase in power consumption, and decrease in color temperature. These lamps were replaced at 13-months, by this point the color of the corals was getting visually affected, even though once again the PPFD output of the lamps had in fact increased.

## Giesmann Mogul 400W Coral Lamps

Three 400W Giesmann Coral lamps were installed on my personal 500G aquarium at home in December 13th 2006 and removed from service May 20th 2008. These lamps were driven by 400W Icecap Electronic ballasts. These lamps were used for 9 hrs/day. Once again data was collected over the life of these lamps. Table 5 shows all the data collected over the life of these lamps. Figures 6 and 7 show the spectral plots of the lamps over time as well as by lamp. Due to accidental over writing of some data files, the spectral plots for 6 months for all lamps, and spectral plot for 3.75months for lamp #3 were lost.

Unlike the other lamps (XM, EVC) these lamps did not show an increase in output over time. This could be due to the fact that electronic ballasts were used and they may regulate the current draw by the lamp better than magnetic ballasts and not allow the lamps to draw more power and increase the output. Once again, it

Table 4: Performance Data for 4 EVC 400W 10000K Lamps at different points in their use

| Lamp | Ballast | Power | Voltage | Amps | PPFD | CCT | Efficiency |
|---|---|---|---|---|---|---|---|
| Lamp #1 0 hrs | Magnetic (m59) | 503 | 122.5 | 4.32 | 205.4 | 7168 | 0.408 |
| Lamp #2 0hrs | Magnetic (m59) | 502 | 122.8 | 4.29 | 209.9 | 7197 | 0.418 |
| Lamp #3 0hrs | Magnetic (m59) | 488 | 122 | 4.27 | 209.3 | 8718 | 0.429 |
| Lamp #4 0hrs | Magnetic (m59) | 502 | 122 | 4.34 | 238.9 | 7559 | 0.476 |
| Lamp#1 3 months | Magnetic (m59) | 548 | 123.5 | 4.61 | 224 | 7538 | 0.409 |
| Lamp#2 3 months | Magnetic (m59) | 519 | 124.3 | 4.37 | 230.9 | 7002 | 0.445 |
| Lamp#3 3 months | Magnetic (m59) | 504 | 124.3 | 4.25 | 211.3 | 7998 | 0.419 |
| Lamp#4 3 months | Magnetic (m59) | 557 | 122.8 | 4.73 | 232.9 | 5898 | 0.418 |
| Lamp#1 7 months | Magnetic (m59) | 512 | 120.2 | 4.43 | 240.2 | 6035 | 0.469 |
| Lamp#2 7 months | Magnetic (m59) | 495 | 120.5 | 4.35 | 171.7 | 6550 | 0.347 |
| Lamp#3 7 months | Magnetic (m59) | 503 | 120.1 | 4.41 | 218 | 6787 | 0.433 |
| Lamp#4 7 months | Magnetic (m59) | 511 | 21.1 | 4.43 | 220.6 | 6549 | 0.432 |
| Lamp#1 13 months | Magnetic (m59) | 650 | 120.2 | 5.71 | 288 | 4287 | 0.443 |
| Lamp#2 13 months | Magnetic (m59) | 564 | 121.5 | 4.85 | 213 | 5648 | 0.378 |
| Lamp#3 13 months | Magnetic (m59) | 569 | 122.6 | 4.82 | 245 | 6718 | 0.431 |
| Lamp#4 13 months | Magnetic (m59) | 573 | 121.7 | 4.89 | 242 | 5719 | 0.422 |

can be seen that there is a larger drop in the blue region of the spectrum resulting in a change in the CCT to lower values. The PPFD over 17.25 months of use only dropped by an average of 21.4%. While this change in output did not seem to have an effect on the coral growth, there were visible changes to the colors of some of the SPS corals as compared to colors when the lamps were new, primarily the darkening of some of the corals, with a fading of some of the blue colors. Personally I could have lived with the color change (it would not be obvious to anyone seeing the tank for the first time) and used the lamps for a month more.

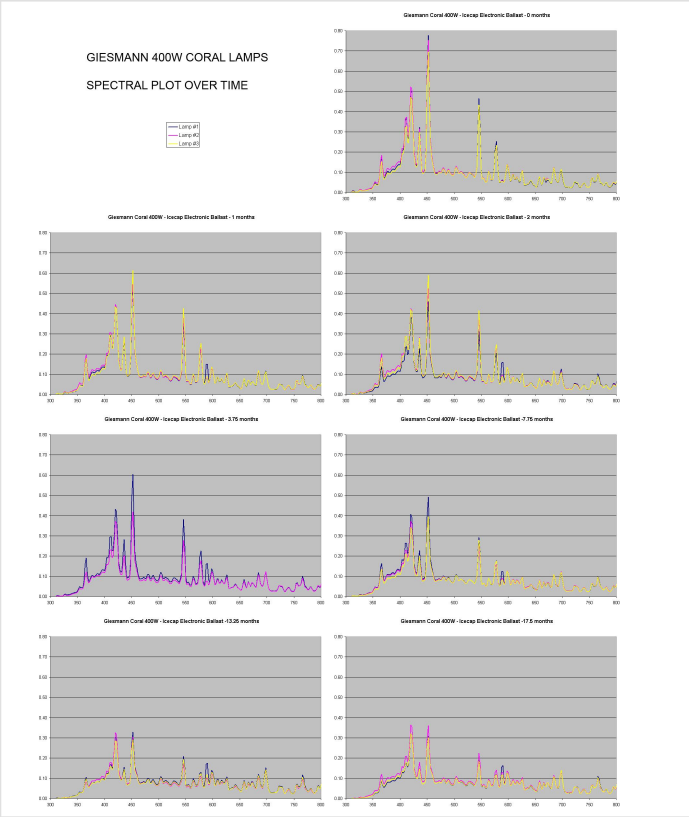


*Figure 6: Spectral plots of the 3 GIESMANN CORAL lamps over time*

## Conclusion

The study presented some very interesting data on the life of metal halide lamps. It reinforced the view that the spectral qualities change over time resulting in the change of the CCT of the lamps to lower values due to reduction in output of the blue portions of the spectrum. In 2 of the lamps (XM, EVC) it also showed an unexpected increase in the PPFD output which can possibly be explained by the fact that there was also a corresponding increase in power consumed. This effect was not seen in the Giesmann Coral lamp,

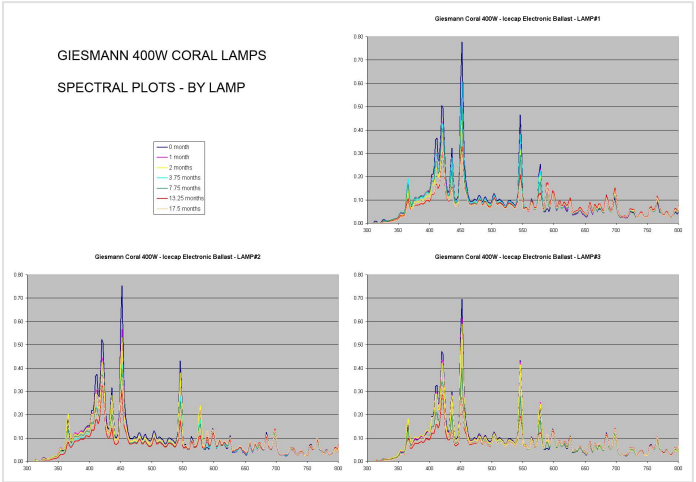


*Figure 7: Spectral plots of the 3 GIESMANN CORAL by Lamp*

Table 5: Performance Data for 3 GIESMANN-CORAL 400W 10000K Lamps at different points in their use

| Lamp | Ballast | Power | Voltage | Amps | PPFD | CCT | Efficiency |
|---|---|---|---|---|---|---|---|
| #1 - 0m | Icecap | 426 | 120.9 | 3.64 | 160.2 | 25969.7 | 0.3761 |
| #2 - 0m | Icecap | 428 | 120.4 | 3.66 | 162.6 | 27708.7 | 0.3799 |
| #3 - 0m | Icecap | 428 | 120.6 | 3.65 | 155.3 | 19823 | 0.3629 |
| #1 - 1m | Icecap | 434 | 121.4 | 3.66 | 145.3 | 13638 | 0.3348 |
| #2 - 1m | Icecap | 432 | 122.1 | 3.64 | 146.2 | 15404 | 0.3384 |
| #3 - 1m | Icecap | 434 | 122.5 | 3.63 | 150.2 | 14292 | 0.3461 |
| #1 - 2m | Icecap | 435 | 121.7 | 3.66 | 139 | 10367 | 0.3195 |
| #2 - 2m | Icecap | 434 | 121.9 | 3.65 | 146.2 | 13374 | 0.3369 |
| #3 - 2m | Icecap | 432 | 121.9 | 3.64 | 148 | 13510 | 0.3426 |
| #1-3.75m | Icecap | 432 | 122.5 | 3.63 | 151.6 | 12907 | 0.3509 |
| #2-3.75m | Icecap | 432 | 122.2 | 3.64 | 129.5 | 11169 | 0.2998 |
| #3-3.75m | Icecap | 433 | 122.3 | 3.64 | 135.8 | 13462 | 0.3136 |
| #1 - 6m | Icecap | 428 | 121.3 | 3.57 | 153 | 14050 | 0.3575 |
| #2 -6m | Icecap | 428 | 121 | 3.57 | 137.3 | 12769 | 0.3208 |
| #3 - 6m | Icecap | 428 | 121.3 | 3.56 | 126.5 | 11228 | 0.2956 |
| #1 -7.75m | Icecap | 432 | 121.4 | 3.72 | 137 | 13201 | 0.3171 |
| #2 -7.75m | Icecap | 432 | 121.1 | 3.72 | 131.3 | 11061 | 0.3039 |
| #3 -7.75m | Icecap | 430 | 121 | 3.71 | 127.7 | 10309 | 0.2970 |
| #1 - 13.25m | Icecap | 430 | 122.5 | 3.63 | 130.3 | 7475 | 0.3030 |
| #2 - 13.25m | Icecap | 430 | 122.2 | 3.64 | 120.4 | 9024 | 0.2800 |
| #3 - 13.25m | Icecap | 428 | 122.6 | 3.61 | 121.3 | 7708 | 0.2834 |
| #1 - 17.5m | Icecap | 426 | 123.1 | 3.58 | 123.5 | 8208 | 0.2899 |
| #2 - 17.5m | Icecap | 425 | 123 | 3.58 | 134.4 | 9148 | 0.3162 |
| #3 - 17.5m | Icecap | 427 | 122.8 | 3.59 | 122.9 | 8611 | 0.2878 |

possibly due to the electronic ballasts being better at regulating the power draw. Another point to note was that the drop in output over almost 17 months of use was around 21%, lower than I would have expected. A similar study by Allen Chantelios [3] using seven 250W DE Phoenix 14000K with Icecap electronic ballasts shows a similar trend of gradual decay over time - of an average of 25% over 12 months. If the change in spectral output is not a big concern, these lamps can be used for much longer periods of time, especially if the fixtures can be lowered by a couple of inches to compensate for the loss in light output.

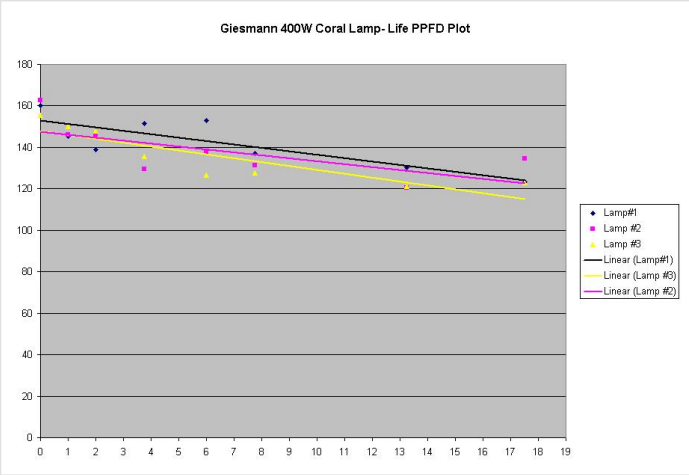


*Figure 8: PPFD output of the 3 GIESMANN CORAL lamps over time*

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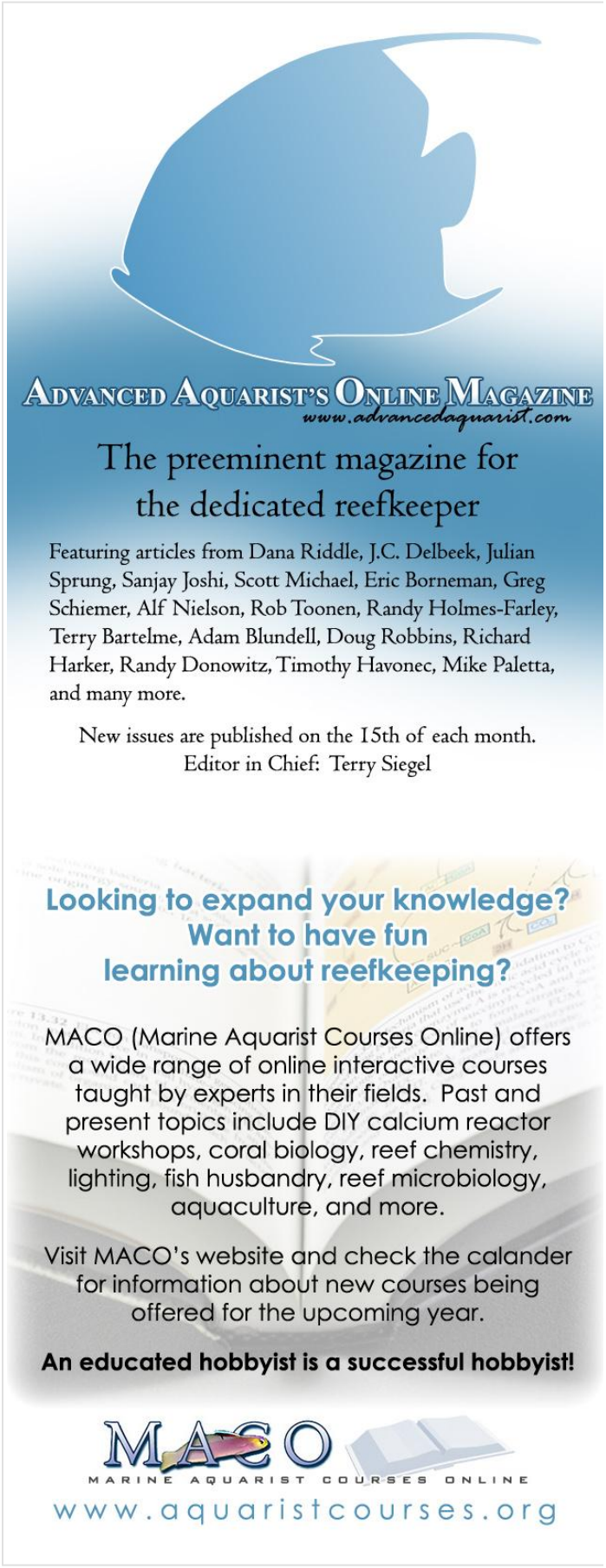
3. Allen Chantelios, "Light Output of the Phoenix 14,000K DE MH Bulb Over Time" Reefkeeping Magazine, April 2007. http://www.reefkeeping.com/issues/2007-04/ac/index.php

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FEATURE ARTICLE

# Coral Reproduction, Part One: A Natural Coral Spawning in Hawai'i, The Cauliflower Coral (*Pocillopora meandrina*)

By Dana Riddle

*Witnessing a coral spawning, especially in the daytime, is an unusual and memorable event. We have much to learn about coral reproduction.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Coral, Dana Riddle, Feature Article, Sunlight, Reproduction, Spawning
Link to original article: http://www.advancedaquarist.com/2008/7/aafeature2

*Pocillopora meandrina* is one of the most common corals of the Hawaiian archipelago. It is also widely distributed across the Indo-Pacific and eastward to the west coast of Central and South America. However, this abundant coral species has some unusual spawning habits. It is one of the few stony corals known to spawn during daytime hours (just after sunrise) and does so during spring months (here in Hawai'i in April and/or May just after the full moon). Surprisingly, this is about all we knew about the breeding habits of this animal.

When preparing for observations of the spawning event, I checked with several marine biologists and got different opinions on what we should expect to see. Some thought we would see male colonies ejecting sperm to fertilize eggs held within a female colony, where they are 'brooded', hatched and ultimately released as relatively large sized planula larvae. On the other hand, we might expect to see gonochoric broadcast spawning (where an individual coral colony is either male or female, and its gametes are released to the water column where eggs and sperm mix for fertilization). Timing of egg and sperm release was in doubt and it was suggested that male and female gamete release could be separated by as much as an hour. In short, we didn't really know what to expect and we would be in for somewhat of a surprise if we were fortunate enough to witness spawning.

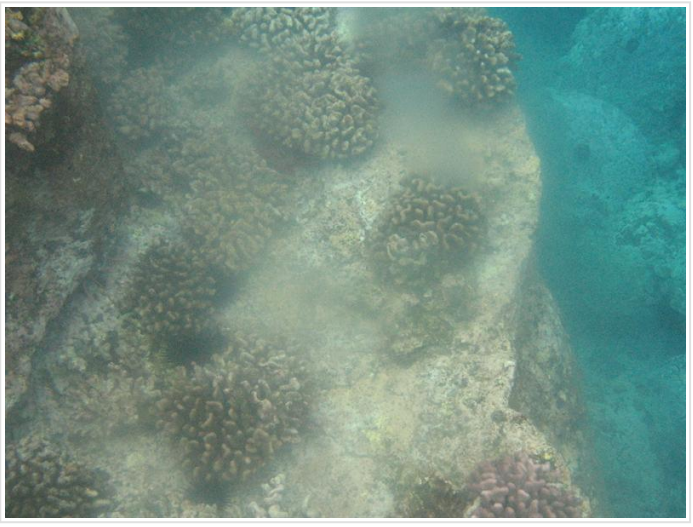

*Figure 1. Spawning Pocillopora meandrina colonies. Billions of coral gametes make the water appear 'smoky'. Photo courtesy of Denise Ulrich.*

Kahalu'u Beach Park is a popular recreational area located near the town of Kailua-Kona on the west side of the Big Island of Hawai'i. Kahalu'u is sometimes called 'Children's Beach' due to the mysterious 'Menehune Wall,' which partially shelters the beach area from extreme wave action (see Figure 2).

(Legend has it that the exposed rock wall (top of picture) was in existence when the first Polynesians arrived on the island. Its existence is attributed to efforts of a race of mischievous 'small people' - the Menehunes.)

Kahalu'u also has an expansive reef flat filled with 'pot holes' which are home to green sea turtles, reef fishes, and, of course, various invertebrates including soft and stony corals.

Early in 2008, I began working with the University of Hawaii Sea Grant College Program Extension Agent and the ReefWatcher volunteers, and began planning to observe the seasonal *Pocillopora meandrina* spawning events. I was placed in charge of selecting a site suitable for a number of observers, where each volunteer took a task, such a photography, data acquisition, and sample collection. I chose Kahalu'u as one of the observation sites. It is usually sheltered from strong wave action, water depth would be shallow at the predicted time of spawning, has readily available public parking early in the morning, water entry is not very difficult and would allow our 'floating laboratory' to be launched with relative ease. It also happens to be about 1 mile from my laboratory - it would be a perfect spot to observe the spawning of the stony coral *Pocillopora meandrina* (commonly known as the Cauliflower coral (Figure 3), or the Rose coral when it contains the pink pigment called 'pocilloporan' - Figure 4). This article will report results of coordinated observations made in April, May and June 2008 along the west coast of the Big Island of Hawai'i.

## A Floating Laboratory

Many reports list long term environmental factors thought to promote and trigger coral spawnings. We approached this differently and decided to investigate the effects (if any) spawning corals might have on their environment, as well as other environmental factors that may act as the final trigger for reproduction, such as light and ultraviolet radiation intensity. To this end, a floating laboratory housing was designed and built with data loggers to record pH, salinity, air and water temperature, plus 'air' and 'water' photosynthetically active radiation (PAR) and ultraviolet radiation (UVR - ultraviolet radiation data is not discussed further in this article). (See Figure 5). Oxidation-reduction potential (ORP) was monitored by a battery-operated meter and sensor, and these measurements were recorded manually.

*Figure 2. The reef flat at Kahalu'u, western side of the island of Hawai'i, one of the sites where Pocillopora meandrina colonies spawnings were reported. Note the submerged light sensors (PAR and UV) and their cords in the lower left hand corner.*

*Figure 3. The Cauliflower coral (Pocillopora meandrina). The pinkish dots are gall crab openings. Photo by the author.*

## Field Observations

The following is a compilation of reports from 22 observers during the *P. meandrina* spawning events of April, May and June 2008.

### Timing of Spawnings

*Pocillopora meandrina* colonies were observed spawning for two days each in April and May, and once in June 2008. Interestingly, the spawnings occurred earlier in the morning during the May spawning events (by as much as 23 minutes earlier) and earlier still in June. See Figures 6, 7, and 8.

Sunrise time was approximately 6:07 am. The most distal observation points (red dots) are ~35 miles apart.

There are many environmental factors influencing chemical and physical aspects of aquatic environments. Since pH, salinity and temperature measurements remained flat slightly before and during the

*Figure 4. A pink color morph of Pocillopora meandrina - little wonder this coral is sometimes called the 'rose coral'. Photo by the author.*

morning of spawning, we will not discuss those further. However other conditions were in state of flux, and include:

## Sunlight

Sunlight, more than any other single factor we observed, seems to play a role in triggering spawning in *P. meandrina*. Unfortunately, this is anecdotal at this time since the data logger recording the underwater PAR and UVR failed during the morning of the observed spawning. However, the other PAR and UVR data logger (recording readings from above the water) functioned flawlessly (see Figure 9). Based on other data sets, we estimate the *Pocillopora meandrina* corals in Kahalu'u Bay spawned when light intensity reached about 40 µmol·m²·sec (April spawning). Interestingly, observers, in some cases, noted that coral colonies in deeper water spawned later than their shallow water counterparts. This deserves further investigation, but our focus changed to gamete collection during the May spawnings and the floating laboratory was not deployed.

## Moonlight

Moonlight, according to some sources, is a fine-tuning mechanism for initiating synchronous coral spawnings, and indeed, moon phase is a convenient way to predict approximate timing of coral reproduction (to within a day or so). Positioning of the moon, in relation to the Earth and Sun, also determines tidal cycles. It is not within the

*Figure 5. The author makes last minute preparations and adjustments to the floating laboratory during the pre-dawn hours of April 22, 2008. Photo courtesy Dave Kearnes (diverdave@smug.mug.com).*

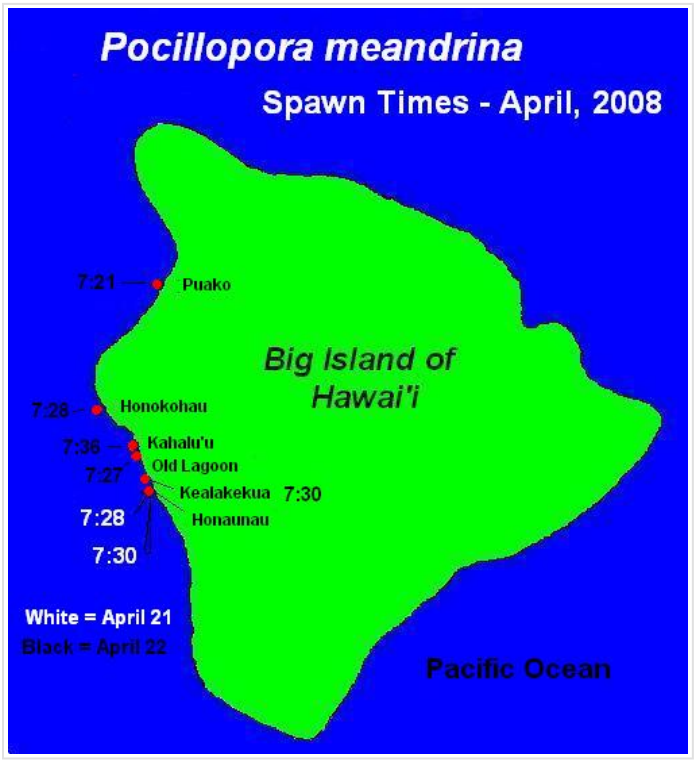


*Figure 6. Sites and times of P. meandrina spawnings in April 2008.*

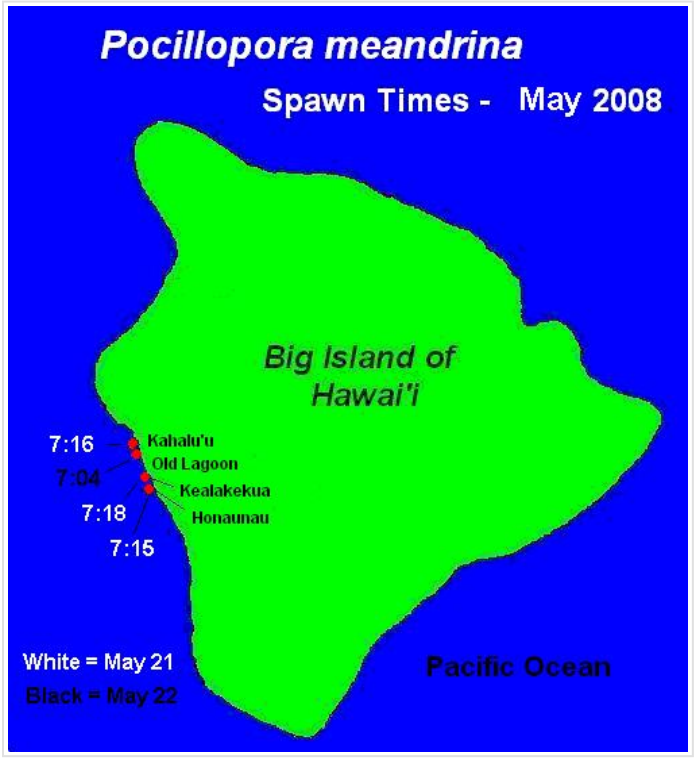


*Figure 7. Times of May spawnings. Note that spawning occurred about 10 to 23 minutes earlier - 'official' sunrise time is 16 minutes earlier than in April, but light intensity can influenced by shadows and clouds.*

scope of this article to discuss coral photoreceptors and moonlight or the influence of celestial bodies on tides (these will be discussed in detail later in this series). For now, we'll present moon phase as a convenient predictor of *P. meandrina* spawnings (See Figure 10).

Figure 11 shows spawning dates and the hours of potential available moonlight in hours.

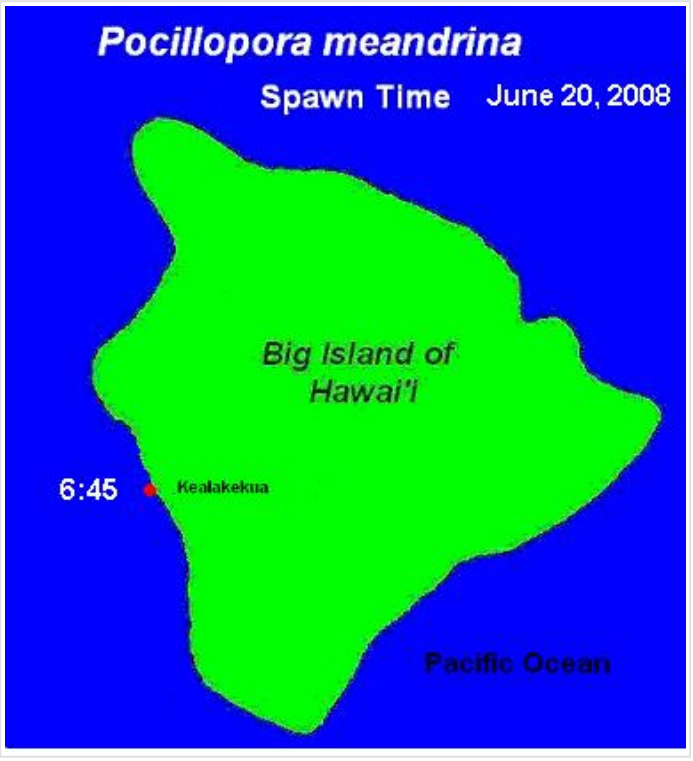


*Figure 8. A minor spawning event occurred in Kealakekua Bay at 6:45 am on June 20, 2008. Note that the spawning was observed earlier than those in April or May. Is the time of sunrise (or light intensity) a trigger for P. meandrina spawnings?*

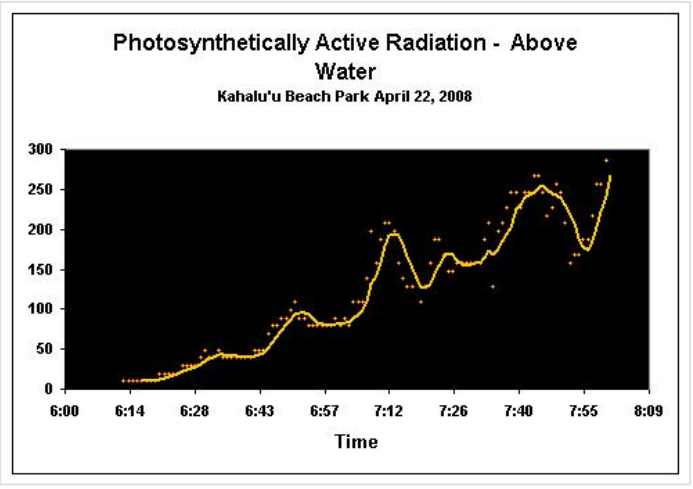


*Figure 9. Surface PAR (Photosynthetically Active Radiation; reported in micromole per square meter per second). Light intensity at the surface of the water at the time of spawning was about 225 µmol·m²·sec (we estimate ~40 µmol·m²·sec underwater). The yellow line is a five-minute running average.*

## Tide

Though moon phase and its possible impact on coral spawning is a matter of debate, there can be little doubt about the importance of tidal action on successful fertilization. *Pocillopora meandrina* colonies spawn on the Big Island during a falling tide, approaching ebb tide, when decreased water depth minimizes dilution of gametes (especially in their preferred environments of high water motion which are generally reef crest and flats).

*P. meandrina* spawns on a falling tide, but it is not at the lowest or ebb tide for the day and is not the lowest low tide for either month (that occurs around the new moon phase). See Figure 12.

There is approximately 1â€ difference in water depths between the April and May spawnings.

## Results from the Floating Laboratory

Of the information we gathered during the April spawning, one parameter showed a surprising trend - that of the reduction-oxidation potential (ORP, or Redox - See Figure 13). We assumed that possible release of hormones from corals could be a signal for mass spawning and had reason to believe that this might be measured using a redox probe. We expected a lowered redox value; instead we saw a sharp rise. This was not a response to probe conditioning and slow response. We are uncertain of why this occurred, and feel it deserves further investigation.

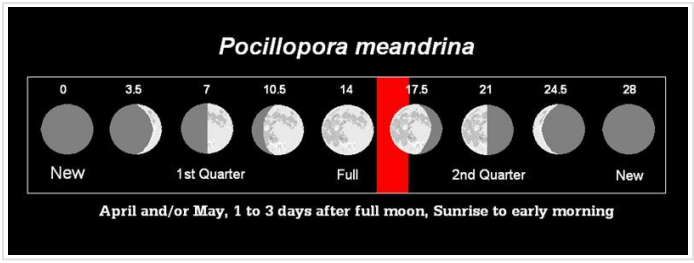


*Figure 10. Spawning period (as lunar days - those numbers above the moon drawings) for Pocillopora meandrina. Some believe the spawning event is only coincidental to moon phase, and that lunar periodicity plays no functional role. Others disagree. We will examine the evidence for and against the role of moonlight later in this series.*

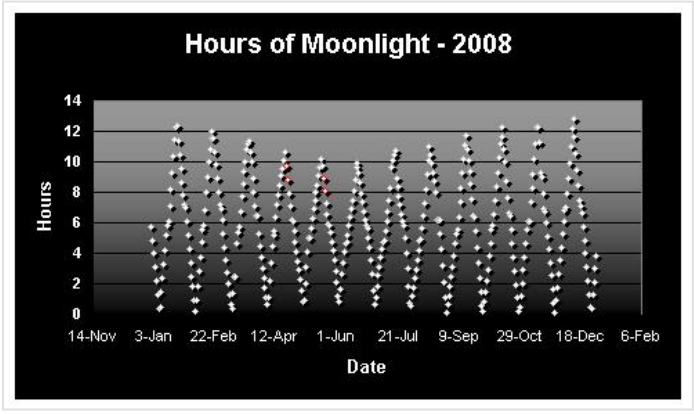


*Figure 11. Hours of predicted, potential moonlight for each night of 2008. The red dots indicate the days in April and May when P. meandrina colonies spawned.*

This concludes our very brief look at the natural environment. We'll now turn our attention to the artificial conditions within a small wet laboratory.

## Laboratory Observations

Even the largest *P. meandrina* eggs we observed were tiny. We used an eyepiece reticle calibrated to a stage micrometer to estimate their diameters (about 100 micrometers, hereafter called microns). The 'average' egg of other coral species is much larger at 400-500 microns. Minimal water currents probably keep the *P. meandrina* eggs in suspension, but when held in laboratory beakers, they were found to be negatively buoyant - they sink. Since lipid droplets within many coral species' eggs cause them to float, it seems reasonable to assume that *Pocillopora meandrina* eggs contain have less lipid content than many other coral eggs.

## Technique Used for Egg Fertilization

In theory, the plan to launch a floating laboratory and collect samples seems like a day at the beach. In reality, it is a lot of work even when the workload is divided among 6 volunteers. Our tasks were made more difficult simply because we did not know exactly what to expect.

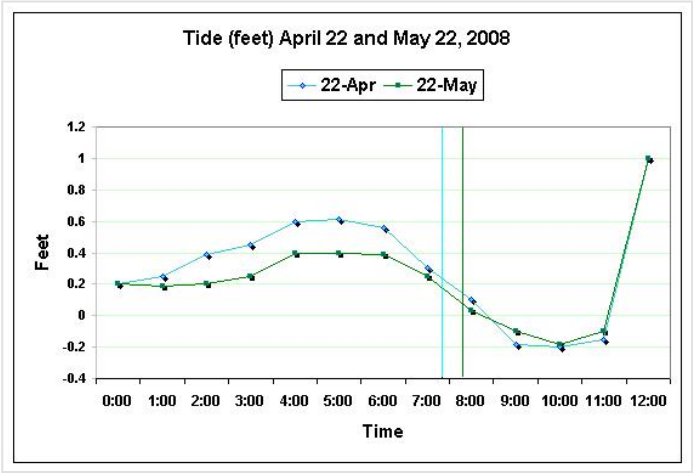


*Figure 12. The P. meandrina colonies spawned on a low, but still falling, tide. Spawning times were 7:36 and 7:16 on April 22 and May 22, respectively (at Kahalu'u). The vertical blue line is time of spawning in April; the green line is for May.*

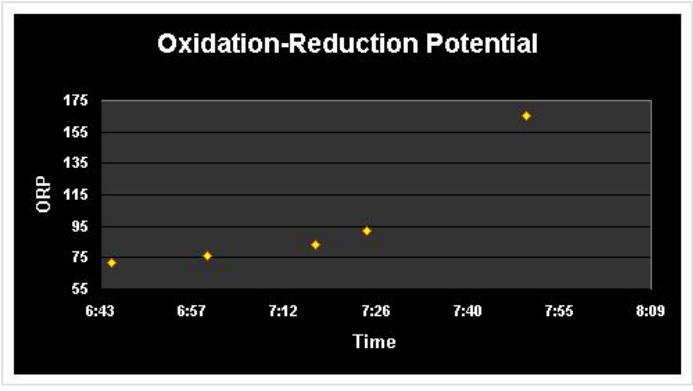


*Figure 13. Oxidation-reduction potential rose sharply during the time of spawning (this was not observed the previous day when no spawning was observed). Spawn time was 7:36 am (Kahalu'u reef flat).*

In my view the most difficult assignment was that of collecting the spawn in the shallows of Kahalu'u Bay. We used two methods - small plankton net (80 micron mesh) was pulled through the water column when spawnings were observed. We also collected gametes with a kitchen baster at the moment of release from the coral. These samples were transferred to Ziplocïƒ" bags. Aliquots were drawn and mixed with the contents of other bags to aid in 'crossing' eggs and sperm from different spawning colonies. These mixed samples were placed in a mesh net bag suspended from the floating laboratory. Other than the gentle rocking motion from wave action, no stirring or mixing occurred after crossing of the samples.

These bagged samples were transported within the mesh bag to the laboratory (~1 mile away). We arrived there about 30 minutes after the spawning event.

April Spawning: Every egg from the very first sample drawn for microscopic examination showed signs of fertilization. The beakers were full of planula larvae about 30 hours after collection, but had disappeared by hour 54. We missed an excellent opportunity to learn much more than we did.

Experience is the best teacher, and we would be more prepared in May for what we realized as an event akin to an aquatic fire drill.

May Spawning: Samples were obtained from Joan Prater and John Lynch (as well as those I collected). Planula larvae were kept alive at ~150 hours of age but they did not settle on the walls or bottoms of the beakers nor did they attach to a substrate covered with a calcareous algae believed to be a *Mesophyllum* species.

June Spawning: Only a few eggs were collected during this weak spawning, and no effort was made to culture them.

*Figure 14. A kitchen baster is used to collect gametes as the coral spawns. Courtesy David Kearnes.*

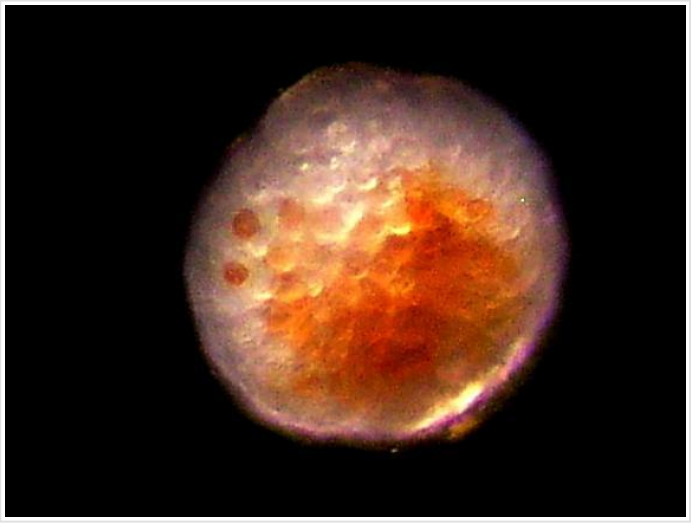

*Figure 15. A Pocillopora meandrina egg. Note zooxanthellae cells within the egg. This egg is the diameter of a human hair. Photomicrograph by the author.*

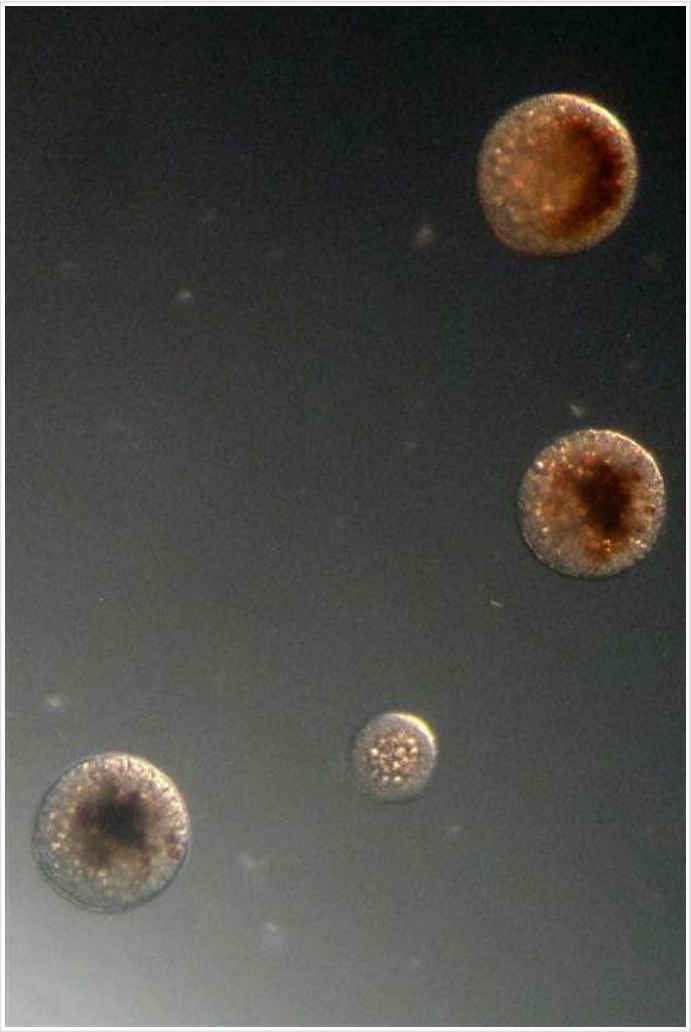

*Figure 16. P. meandrina eggs were collected with a kitchen baster at the moment of release. Some eggs did not seem mature (as evidenced by their size), and not all contained zooxanthellae. Photomicrograph by the author.*

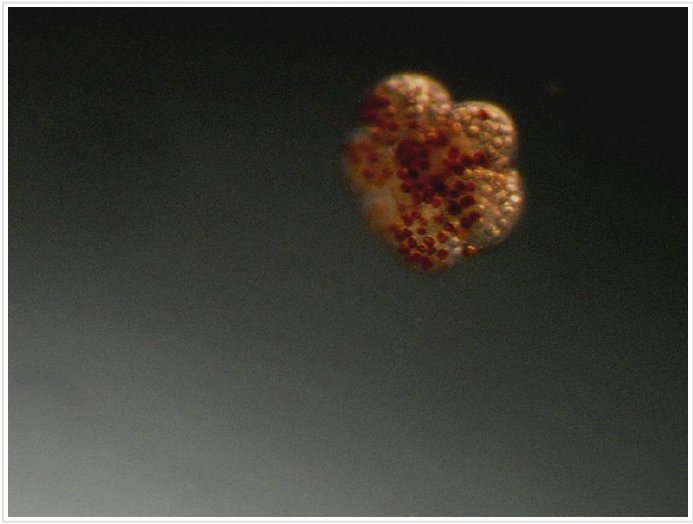

*Figure 17. A fertilized egg showing signs of cleavage about 4 hours after sample collection. It is on its way in becoming a larva. Photomicrograph by the author.*

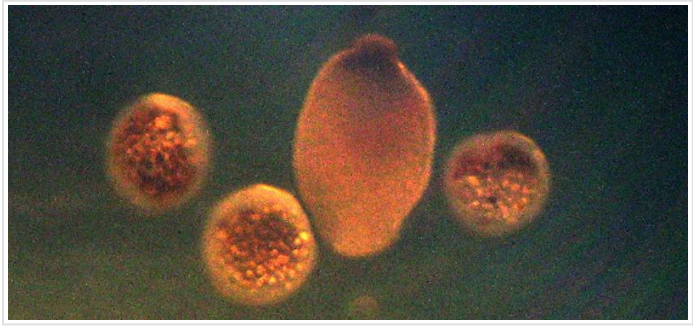

*Figure 18. Eggs and a planula larva of Pocillopora meandrina. Since planula larvae take time to develop, this photo suggests a previous, unobserved spawning had occurred. Photomicrograph by the author.*

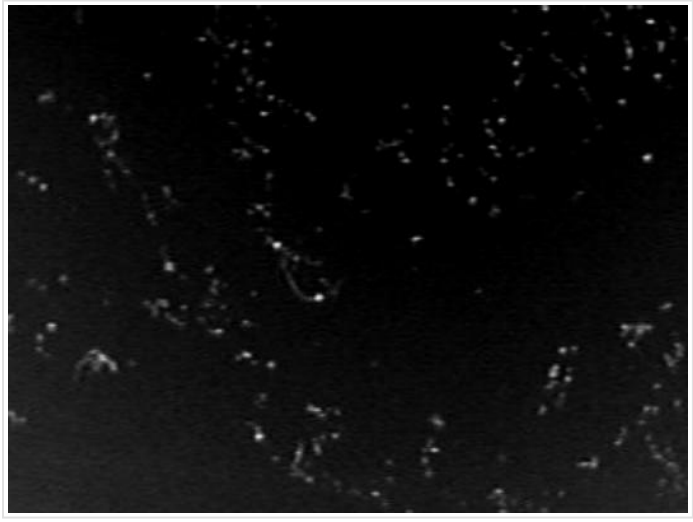

*Figure 19. P. meandrina sperm are barely visible in this photomicrograph negative image. Photo by Barbara Kuehner, University of Hawaii Center, West Hawaii.*

## Summary

A synopsis of our observations for Pocillopora meandrina spawnings along the west coast of the Big Island of Hawaii is:

- *Pocillopora meandrina* colonies are hermaphroditic and simultaneously broadcast eggs and sperm
- Spawning is seasonal and is extended over the course of at least 3 months (1 more month than previously described)
- Egg cleavage can begin several hours after the spawning event
- Sperm are still alive after ~10 hours (but viability is likely reduced)
- Eggs contain zooxanthellae (symbiont transmission is vertical)
- Eggs are negatively buoyant
- Eggs are of various sizes, but all are 100 microns or less
- Planula larvae are apparent as late as 24 hours after eggs are fertilized
- Planula will collect at the surface in very calm water
- Planula larvae are small (200-250 microns)

## In Closing

Witnessing a coral spawning, especially in the daytime, is an unusual and memorable event. We have much to learn about coral reproduction (a comment was made that we know more about moon rocks than we know about the reproductive habits of corals, some living in only a foot or two of water).

*Figure 20. A copepod seems huge next to a P. meandrina egg. A blue light was used to check for green fluorescence within the egg - it was not found, but the light source made objects appear bluish. Photomicrograph by the author.*

Countless hours of research and preparation preceded our observations, yet this barely readied us for the all too brief spawning activity and the hours of laboratory observations and experiments that followed (I will never again sit in an air-conditioned laboratory for 6 hours in a very wet and cold wet suit!).

This article closes now but it is only the first of a series entitled '*Coral Reproduction*.' Next time, we'll look at asexual coral reproduction in aquaria and lay a foundation for future articles in this series. We'll examine what we're doing right, and what improvements could be made. More importantly, information will be presented in order to improve our chances of successful sexual coral spawnings.

## Acknowledgements

My hat is off to all the observers along the coast of west Hawaii who, instead of staying in bed, braved pre-dawn darkness, a south swell and strong surf to find their ways into tide pools, reef flats and deeper reefs (often traversing lava rocks still wet and slippery from a falling tide). Volunteers snorkeled and SCUBA dived in the subtropical Hawaiian ocean that is still cool enough at this time of year to wake you up in a hurry. In particular, Sara Peck with the University of Hawaii Sea Grant program toiled tirelessly to coordinate volunteers' efforts. David Kearnes (diverdave@smug.mug.com; http://www.pacificwatercolors.com) donated his time, talent and underwater photography gear to document the spawning at Kahalu'u Bay (see Figures 5 & 14). Barbara Kuehner with the University of Hawaii Center, West Hawaii, collected gamete samples and provided several photomicrographs (Figure 19 is one result of her efforts). Denise Ulrich was kind enough to share her photographs (one is published as the introductory photo). John Lynch, Bruce Brooks, Kevin O'Connor, Bob Ruhsak, Joan Prater, Matt Binder, Dallas Schaffer, Catherine Wynn, Ambika Rose, Janet Christmann, Robin Bourdon, Suzie Weaver, Pam Higgins, Sammie Stanbro, Bo Pardau, Bob Teytaud, Jennifer Rabalais and Peggy Spelman also added their observations from up and down the west coast of the Big Island. My sincere apologies to anyone I have inadvertently omitted.

Dr. Fenny Cox (Hawaiian Institute of Marine Biology) was kind enough to share her thoughts and describe methods for maintaining planula larvae *in vitro*. Amy Apprill (University of Hawaii, Manoa) and Heather Marlow also took time from their busy schedules to relay their experiences with *Pocillopora meandrina*.

## Reference

1. Cox, E., 2006. Connectivity of *Pocillopora meandrina* populations: Genetic and oceanic approaches. Hawaii Institute of Marine Biology and Joint Institute of Marine and Atmospheric Research, Grant Number NA04NOS4260172.

REEFKEEPING EVENTS

# What's Happening in Your Area?

## By Advanced Aquarist Readers

*Check to see if an event is happening in your area!*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Advanced Aquarist Readers, Reefkeeping Events
Link to original article: http://www.advancedaquarist.com/2008/7/events

### Do you have an upcoming event?

If so, please email us at feedback@advancedaquarist.com and let us know about it!

### Summary of Upcoming Events

1. Rochester Minnesota Marine Aquarium Club (RMMAC) Community Meeting, July 20
2. Chattanooga Reef Club Frag Swap, August 16
3. Reefkeepers Weekender, August 29 - September 1
4. MACNA XX, September 5 - 7
5. West Tennessee Frag Swap and Aquarium Show, September 27
6. Southern Colorado Marine Aquarist Society Frag Swap, October 4
7. Second Annual Oklahoma City Conference for Reef Aquarists and Saltwater Enthusiasts (CRASE), October 25
8. Reef-A-Palooza (a Southern California Marine Aquarium Society event), October 11-12
9. Marine Aquarium Expo, April 3-5, 2009

### Rochester Minnesota Marine Aquarium Club (RMMAC) Community Meeting, July 20

When: Sunday July 20th 5:00PM
Where: Exotic World of Fish, 1137 6th Street NW, Barlow Plaza, Rochester, Minnesota 55901
Phone: 507.424.1690
Website: http://www.thereeftank.com/forums/f79/rmmac-sunday-july-20th-community-meeting-details-117375.html

Agenda:

- 5:00PM-5:30PM Dinner & Social + Sell Raffle Tickets
- 5:30PM-5:45PM EWOF Store tour & talk by EWOF
- 5:45PM-6:00PM Do It Yourself (DIY) water top off system, by Brad O.
- 6:00PM-6:15PM Raffle Drawing
- 6:15PM-6:30PM Club Business

Tickets will be sold for $5 per ticket. At 6:00PM tickets will be drawn, with the first ticket drawn being the first to pick from the raffle items, second second, and so forth. If there is nothing left that a person wants, the next ticket is drawn. All money taken in will be RMMAC club funds to use in promoting & growing RMMAC and other club uses. There is a limit of ONE gift certificate per person as a prize.

Raffle Items (more to come):

- $20 EWOF Gift Certificate
- $20 EWOF Gift Certificate
- $20 EWOF Gift Certificate
- 10-20 lbs of aragonite base rock in a free bucket donated by Ben (Ben E.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 2 heads - donated by mjsandbe (Michael S.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 4 heads - donated by mjsandbe (Michael S.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 4 heads - donated by mjsandbe (Michael S.)
- Metalic Green Millipora Frag - donated by mjsandbe (Michael S.)
- Orange Montipora Frag- donated by mjsandbe (Michael S.)
- Tri-Color Acropora Small Frag - donated by mjsandbe (Michael S.)
- Tri-Color Acropora Small Frag - donated by mjsandbe (Michael S.)
- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)
- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)

- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)
- Kalkwasser Reactor - donated by mjsandbe (Michael S.)

Rochester Minnesota Marine Aquarium Club (RMMAC): Our purpose is to enhance the hobby, and grow a community, by promoting the exchange of information, equipment, and livestock. We are located in SE Minnesota, centered on Rochester, and we welcome all to join from the surrounding areas.

## Chattanooga Reef Club Frag Swap, August 16

When: August 16, 12:00 PM - 4:00 PM EST
Where: Ooltewah United Methodist Church, 6131 Relocation Way, Ooltewah, TN 37363
Website: http://www.reef2reef.com/forums/showthread.php?t=10762

The Chattanooga Reef Club and its members would like to invite you to their annual Frag Swap! Join fellow reefers from around the region for this 7th installment of this event. Buy, sell, trade, or browse coral and equipment! Meet other reef hobbyists from all around the Southeast and enjoy this time of fun, fellowship, and of course some major fragging!

- Buy, sell, and trade coral and equipment
- How to frag coral demonstration
- Cost is $1 for card carrying club members, $3 for non-club members, and $10 to rent a table to sell.
- Dozens of commercial and hobby level sellers and traders.
- Many raffle prizes including skimmers, lighting, gift certificates, frags, and much more.
- Concession stand style food if you get hungry!
- Everyone is welcome to attend!

We are very excited about this year's swap! We have Dr. Mac from Pacific East Aquaculture coming with 100's of corals, Dennis Tagrin of DT's Plankton Farm, Randy Reed from Reef Nutrition/Reed Mariculture, Matt Carberry From Sustainable Aquatics and a few more in the works. There are donations to be raffled off from several major companies including Red Sea, Seachem, Reef Geek, Current, Hamilton Technology, AirWaterIce, Reef Doctor Micromussas, Cherry Corals, Carib-Sea and more to come!! We hope to see you all there!!

## Reefkeepers Weekender, August 29 - September 1

Date: Friday, August 29 through Monday, September 1, 2008
Location: Pontins, Pakefield, Suffolk (2 hours from London, 3 Hours from Birmingham)

The Reefkeepers Weekender has grown steadily since it's inception, and last year was a really fantastic weekend, with superb presentations, a Quiz, brilliant raffle prizes, cabarets, plenty for the kids, and LOTS of late night chat (and a fair bit of Resolve sold in the shop!).

The highlight of the weekend will be, in additon to the usual raffle and quiz, presentations by none other than world renowned experts:

- Mr Anthony Calfo, Author of two of the "Bibles" of reef keeping, "The Book of Coral Propagation" and "Reef Invertebrates" amongst others. Anthony has also recently had articles in "Ultra Marine" magazine.
- Top Dutch expert, Mr. Ron Hessing. Ron writes for Koralle magazine in Germany, A Journal in the USA, and his own site www.marineaquarium.nl and has spoken publically at events around the world, most famously, MACNA and the Boston Reefers Society.

As well as these eminent experts, there will be other presentations, to be confirmed. Details of what their presentations will be will follow a bit nearer the time.

It is essential that you book now if you want to come this year. Last year, the holday park was full, and some of those that wanted to come were disappointed. So, don't delay your decision this time people. It is bound to be over subscribed with a line up like this, so get in there and secure your place. You need to contact Pontins, Pakefield to book on 01502 502 900. Tell them it is for the Reefkeepers Weekender, and make sure you give them your UR name as well your real one, so that we can issue badges.

For 3 nights Fri, Sat and Sun, it is £60 and half price for Under 18's. This is half board, so a full Breakfast and Evening Meal each day are included. There will be Trade Stands and Give-aways too, and, of course, a chance to meet up for our annual chin wag and party! You do need to book this now! It has become one of the leading UK meets of the year and you don't want to miss it!

## MACNA XX, September 5 - 7

Date: Friday, September 5 through Sunday, September 7, 2008
Location: The Westin Peachtree Plaza, 210 Peachtree Street, Atlanta, Georgia 30303
Website: http://www.macnaxx.com

Presented by Atlanta Reef Club and MASNA, MACNA is the largest hobbyist marine conference in North America. New aquarium products, vendors will often wait until MACNA to release new products into the hobby. Hobby professionals, you will have a chance to meet and mingle with professionals in the hobby like Eric Borneman and Anthony Calfo. A chance to be at a conference with hundreds of other people just as obsessed with aquariums as you are.

We have selected the Westin Peachtree Plaza as the host hotel for this event. It is the tallest hotel in the western hemisphere. Our negotiated room rate is $119.00 per night with discounted parking. Everyone that stays in the hotel will be given free internet access from their rooms.

This 73-story tower, topped by the revolving Sun Dial Restaurant, Bar & View, graces the heart of Atlanta. Connected to AmericasMart, The Westin Peachtree Plaza, is steps from CNN, Georgia Aquarium, Georgia World Congress Center and the Georgia Dome.

Contact Information:

MACNA XX
1266 West Paces Ferry Rd.
Suite 194
Atlanta, GA 30327
PHONE:
FAX: 860.540.2351
E-mail: info@macnaxx.com
Contact Form

## West Tennessee Frag Swap and Aquarium Show, September 27

When: Saturday, September 27, 10 AM - 4 PM
Where: 5719 Quince Rd, Memphis, TN 38119 (map)
Phone: 901-359-2199
Website: http://www.wtmrac.org/newfragswap.htm

Come learn more about the marine reef and aquarium hobby. Admission is $3/person. Coral frags for sale or trade. Great raffle prizes! Frag Demo. Table space available for $15 (reserve in advance).

For more information, either call 901-359-2199 or email klug3@comcast.net.

## Southern Colorado Marine Aquarist Society Frag Swap, October 4

Date: Saturday, October 4th, 2008
Location: Crowne Plaza Hotel, 2886 South Circle Drive, Colorado Springs, CO 80906 (map)
Website: http://www.scmasfragstock.com/

The SCMAS FragStock will take place on October 4th 2008 at the Crowne Plaza Hotel in Colorado Springs Colorado. This event will feature Marine Livestock (no Fish) and Dry Goods vendors from Colorado as well as national vendors from around the country. The event will take place in the Salon A Grand Ballroom and feature raffle items and amazing corals. Check back frequently as vendors are added to the list. We will also be listing the Raffle items on this site as well. Below is the event layout (subject to change) and some pictures of the Hotel. For more information or if you would like to be a vendor please send an email to Ldogg@thescmas.com.

## Second Annual Oklahoma City Conference for Reef Aquarists and Saltwater Enthusiasts (CRASE), October 25

When: October 25, 2008, 10 AM to 6 PM
Where: University Central Oklahoma Conference Center
Admission: Adult tickets are $15 each for general admission, $25 with prepaid gourmet box lunch. Children are $10 each for general admission, $20 with prepaid gourmet box lunch.
Website: http://www.mycomas.com/content/view/89/102/

After the fabulous success of CRASE 2007, Aquariums Tropical Fish Supply and the Central Oklahoma Marine Aquarium Society are pleased to announce the second annual Oklahoma City Conference for Reef Aquarists and Saltwater Enthusiasts (CRASE). This will be a single day event and will comprise keynote lectures by distinguished speakers in the area of saltwater aquariums. In addition, the President of COMAS, Dr. Paul Whitby, will be discussing aquascaping. There will also be a hobbyist frag sale, vendor and trade displays as well as numerous door prizes.

The list of prizes is beginning to take shape, please remember to stop by and check as it grows. For now, here are a few of the door prizes we will have:

- Gift Certificates to Aquarium Oddballs
- Gift Certificates to Aquariums Tropical Fish Supply
- Gift Certificates to Zoanuts
- And the Grand Prize this year is: A complete 75gallon Reefready system. This comprises a 75g All Glass mega flow tank (Donated by Aquariums) a custom built Oak Stand and Canopy, 2 4 foot T5 lights, return pump, plumbing for the overflows and a sump. The stand and canopy are not stained so that you can match the system to your house decor. This prize is worth over $1,500.

Guest speakers will be:

- Dr. Ron Shimek: Firstly, it is with great pleasure that the organizers of CRASE wish to announce that --after a great deal of requests from COMAS members---Dr. Ron Shimek will be returning to CRASE. Dr. Shimek will be discussing invertebrates used as clean up crews, commonly available and some not so commonly available. His talk will encompass the pros- the cons- the dos and the don'ts.
- Adam Mangino: The second presenter is a new face to the CRASE. Adam Mangino is one of the ORA team and is primarily involved with their captive breeding program and in particular he is responsible for the hybridization to create the indigo dottyback. He will be talking on captive breeding of marine ornamentals.
- Dr. Sanjay Joshi: Also new to the CRASE is one of the most respected names in reef tank lighting. Dr. Sanjay Joshi has published numerous articles on spectral qualities of bulbs and the effect of various reflectors. It is fair to say the level of expertise he will be bringing to the CRASE is outstanding and I very much look forward to meting him. Dr. Joshi will be discussing various options in reef lighting with particular respect to both T5 and MH technology.
- Dr. Paul W. Whitby: Dr. Whitby is President of the Central Oklahoma Marine Aquarium Society (COMAS) and has over 20 years experience as a saltwater hobbyist. Dr. Whitby will be discussing aquascaping techniques.

## Reef-A-Palooza (a Southern California Marine Aquarium Society event), October 11-12

When: October 11-12
Website: http://www.reefapalooza.org/index.html

Reef-A-Palooza (RAP) is an annual event promoted by the Southern California Marine Aquarium Society (SCMAS). Now in its fourth year, RAP can best be described as an indoor marketplace where sellers, exhibitors, and hobbyists of all types can buy, sell, trade, showcase their products to the marine hobbyist community. The main purpose of Reef-A-Palooza is to provide an enjoyable, positive atmosphere that is conducive to education and trade of both product and knowledge. As such, participating vendors range from large manufacturers, to retailers, to small livestock sellers, and participating hobbyists range from the beginner to the elite, rare-species coral farmer. It is the perfect venue to showcase new products in the marine aquarium industry as well as retail products for sale. We strive to rally a diverse range of participants into the one-day event so as to present the best value and interest to everyone involved. Considering our current bookings and the popularity of previous years, we expect 60+ vendors/exhibitors and well over 1,000 attendees this year!

Reef-A-Palooza provides the perfect venue for marine aquarium hobbyists to meet fellow enthusiasts, exchange information, and trade, and learn about new products. One of our main goals at Reef-A-Palooza, and within SCMAS, is to educate and enlighten the public with the latest knowledge in marine animal husbandry skills and environmental responsibility. For instance, SCMAS fully encourages the rapid advancement and allure of coral propagation as a viable alternative to wild harvest collection practices. As such, many of our booth vendors are local hobbyists who grow their own corals specifically to sell and trade at Reef-A-Palooza and similar events. SCMAS thoroughly encourages this type of "green commerce" for both the betterment and future of our hobby, as well as the resulting benefit to the marine environment.

Reef-A-Palooza is focused mainly to cater to the vendor and hobbyist, rather than as an educational conference. As such, we tend to attract customers who come specifically for the purpose of buying and seeing all the different exhibitor's booths and displays. Nonetheless, speakers, raffle drawings, and other entertainment are provided to help keep people around for most of the day, even after seeing all the booths. In addition, our promotional and marketing efforts are nearly guaranteed to attract high participation and attendance rates, and hence, heavy foot-traffic throughout the building. RAP 2007 is going to be HUGE this year due to the popularity of its new venue (Orange County Fair & Exposition Center, Building #14) as well as the number of sellers, vendors, and manufacturers involved. We now have 18,000 square feet of indoor, climate-controlled space in which to make this event a resounding success. Now into its fourth year, Reef-A-Palooza has quickly gained the reputation as an event that is NOT to be missed!

## Marine Aquarium Expo, April 3-5, 2009

When: Friday, April 3 - Sunday, April 5; 12:00 PM - 6:00 PM
Where: OC Fair & Event Center, 88 Fair Drive, Costa Mesa, CA 92626 (map)
Phone: 714-708-1500
Admission: $10 for Adults, $5 for Seniors, and FREE for Children 12 and under
Website: http://marineaquariumexpo.com/

Marine Aquarium Expo" (MAX), is southern California's premier indoor consumer-tradeshow, bringing together manufacturers, retailers, and saltwater enthusiasts from all over the nation into one giant, centralized location. More than 100 booths fill 22,000 square feet of exhibitor floor space plus another 7,000 sq. ft. of covered courtyard to accommodate speakers, raffle drawings, Club booths, and various workshops. MAX is the perfect venue to see the latest innovative products and offerings as well as the most progressive enterprises in the marine aquarium business. MAX is a spectacular marketplace for selling/trading of livestock, equipment, supplies, and various other goods. Literally THOUSANDS of coral frags are available for sale from the dozens of livestock exhibitors attending Marine Aquarium Expo. We invite you to bring the entire family to see what the excitement is all about. MAX is an event that you do NOT want to miss!

- Two Full Days of festivities, trade, and entertainment! Do not miss this event!
- Giant Market of Manufacturers, Wholesalers, Retailers, Hobbyists and more!
- Livestock Dealers selling corals, frags, fish, invertebrates, and more
- Courtyard classes provides a wealth of entertainment and learning experiences
- Many booths, workshops, and educational displays represented by clubs and charities
- Huge Drawing both days with many, many, Major Prizes to WIN!
- Manufacturers showcasing the latest equipment, products and services available!
- Six Speakers from all over the United States come to demonstrate, educate, and inspire

LATERAL LINES

# FINCH SHUTOFF RELAY

By Adam Blundell M.S.

*The Finch Shutoff Relay is a great electrical invention. This item will undoubtedly prevent many overflows (it has saved me already).*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Adam Blundell M.S., Electricity, Flooding, Lateral Lines
Link to original article: http://www.advancedaquarist.com/2008/7/lines

Recently a new danger has emerged in the reef keeping hobby... flooding. Okay so flooding itself has been around since day 1 of the hobby, but a new wave of flood problems is entering the hobby.

## THE PROBLEM

New methods of high power skimming feature large volumes of air injected or drawn into water columns. These skimmers work great when they are functioning properly. Unfortunately these skimmers are prone to overflow and malfunction. One of the most common problems is over injection of air following a power outage. During a power outage the feed pump to the skimmer shuts off and the skimmer water level often drains down. Once the power returns the water level begins to rise but this happens at the same time as the over injection of air. This produces an overflow of bubbles which many hobbyists (including the author) have had come pouring out the skimmer (several gallons of water over flowing).

## THE FIX

For this project I contact expert reef hobbyist and engineer Jon Finch. Jon has a real gift for ingenuity. Like so many times before, Jon came through. He designed the The Finch Shutoff Relay. This electrical devices was designed by Jon to match my criteria 1) when the power goes off the system is shut down 2) when the power comes back on the device stays shut down 3) the system can be easily restarted and 4) the system continues to run until the next power outage.

Jon designed this circuit using a 110 volt relay wired to form a holding circuit. Once the relay is energized the circuit is held closed by the relay. If power is cut to the relay the contact drops and the circuit is broken (open). In order for the circuit re-activate you would have to re-energize the relay. This is a perfect fix for my problem.

## HERE IS HOW IT WORKS (NON ELECTRICAL PERSPECTIVE)

My skimmer is running just fine. Then the power goes out. The skimmer shuts off. At some later time the power comes back on. This skimmer STAYS OFF until I physically push the reset button. Once I push the button the skimmer turns back on. This is very important because the skimmer only comes back on while I'm there watching it and controlling the air intake to prevent a flood. If I'm not there to push the button the skimmer STAYS OFF.

## HERE IS HOW IT WORKS (ELECTRICAL PERSPECTIVE)

Power (hot wire) runs to a relay terminal (fixed contact). Opposite this contact on the open sided moving contact the hot wire runs to the outlet. This means power is NOT running to the outlet until the armature is engaged and moves towards the open contact. This is not achieved until the coil is energized and the magnetic field pulls

the moving armature to the contact. In order to energize the coil this device makes you push a momentary button.

In addition this devise is wired with a holding circuit so once activated (by the momentary button) the coil stays energized and will stay energized when the button is released. If this doesn't make any sense to you don't feel bad. It took me a good long while to understand the diagram.

## Assembly Steps.

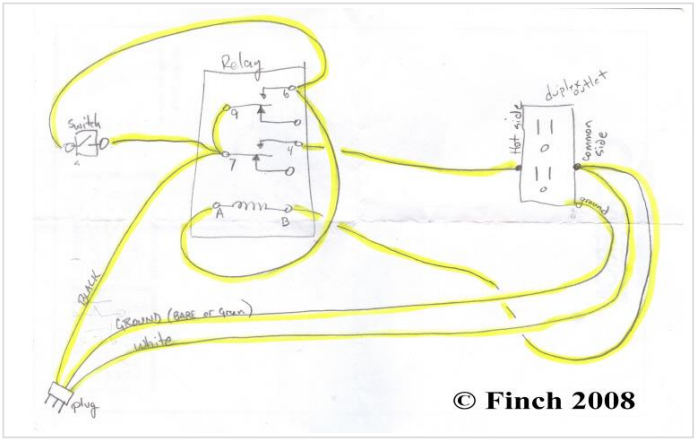
I purchased all the parts for this project from two places. One was a local hardware store (shout out to Home Depot… I'm there a couple times per week) and the other was an electronic supply house. Added up the total parts list for this project cost me $35.

Needed Items:

- 15-20 am 110 volt relay
- Relay socket
- Momentary On/Off push button
- Double space max deep "old work" electrical outlet box
- Duplex Outlet
- Double outlet box cover (one side blank if you can find it)
- Extension cord and hook-up wire

Following Finch's original wiring diagram and I compared my relay to the relay in his diagram and numbered my contacts accordingly. For instance my relay socket had the A and B coil terminals labeled as 7 and 8. Finch's number 7 stationary contact was numbered 5 on my socket. So I made a comparison chart of how my relay socket corresponded to his diagram.

From there it was just a matter of connecting wires. Very easy, but with a ton of wire I took my time to make sure I not only had them all but had them in the correct places. WARNING- don't do this yourself if you don't know what you are doing. Find help, or hire someone. I want you to burn your house down and blame me for it. If that does happen, the least you can do is blame Jon and not me.




*Jon Frinch wiring diagram.*

Advanced Aquarist's Online Magazine
www.advancedaquarist.com
The preeminent magazine for the dedicated reefkeeper
Featuring articles from Dana Riddle, J.C. Delbeek, Julian Sprung, Sanjay Joshi, Scott Michael, Eric Borneman, Greg Schiemer, Alf Nielson, Rob Toonen, Randy Holmes-Farley, Terry Bartelme, Adam Blundell, Doug Robbins, Richard Harker, Randy Donowitz, Timothy Havonec, Mike Paletta, and many more.
New issues are published on the 15th of each month.
Editor in Chief: Terry Siegel

Looking to expand your knowledge?
Want to have fun learning about reefkeeping?
MACO (Marine Aquarist Courses Online) offers a wide range of online interactive courses taught by experts in their fields. Past and present topics include DIY calcium reactor workshops, coral biology, reef chemistry, lighting, fish husbandry, reef microbiology, aquaculture, and more.
Visit MACO's website and check the calander for information about new courses being offered for the upcoming year.
An educated hobbyist is a successful hobbyist!
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www.aquaristcourses.org

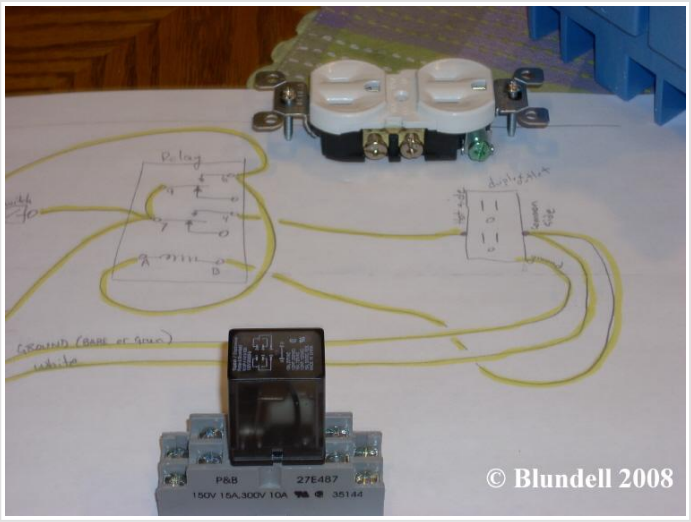
Make sure you keep track of which contacts are stationary and which contact points move. Assemble following the wiring diagram and insert into the outlet box. It takes some maneuvering but you can fit the relay and socket in there as well. Drill a hole in the blank side of the cover (I couldn't find a blank sided cover) and you have a perfect place to put your reset button.

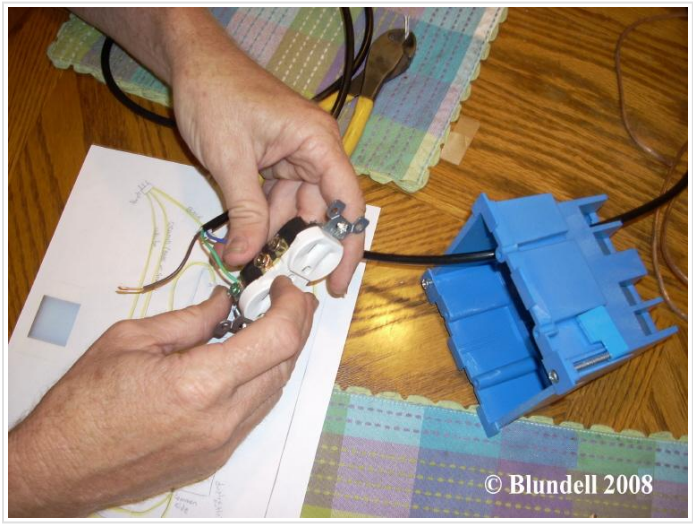
## Conclusion

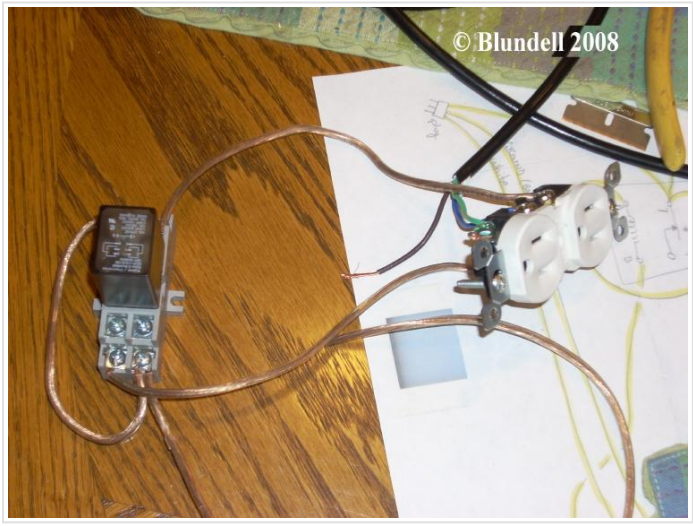
The Finch Shutoff Relay is a great electrical invention. This item will undoubtedly prevent many overflows (it has saved me already). If you are interested in building your own relay switch I recommend contacting Jon Finch directly. This friendly friend can be found at jfinch@xmission.com or by contacting the author of this article.

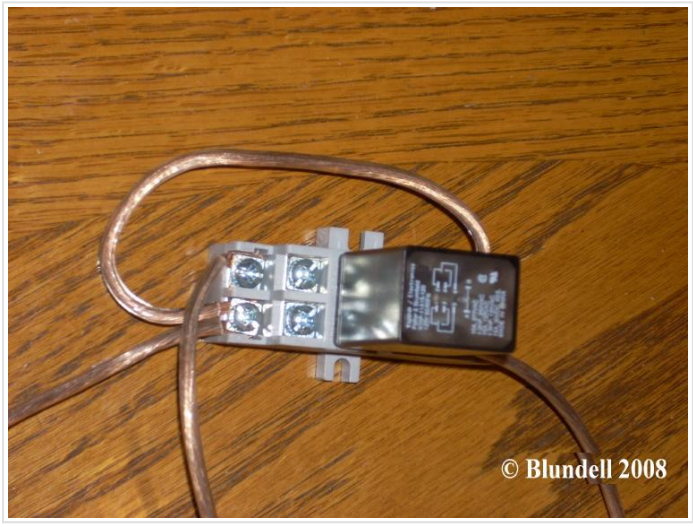
Finally, a very big and personal "thank you" to Jon… not for designing this system but for his ongoing friendship.

Detailed pictures of assembling the Jon Finch Shutoff Relay:



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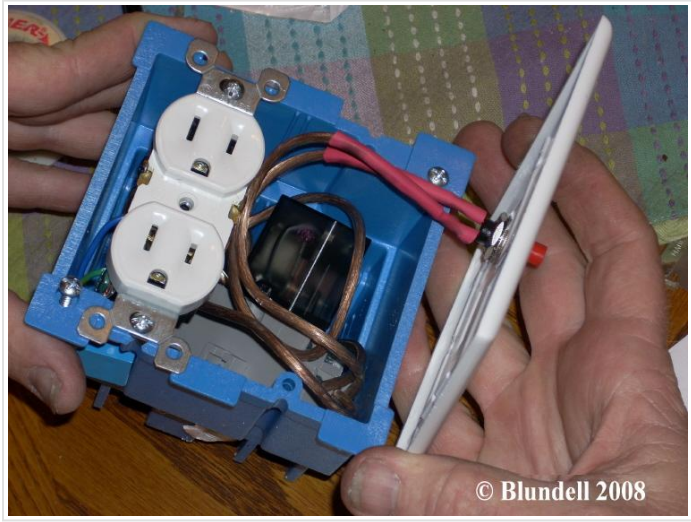
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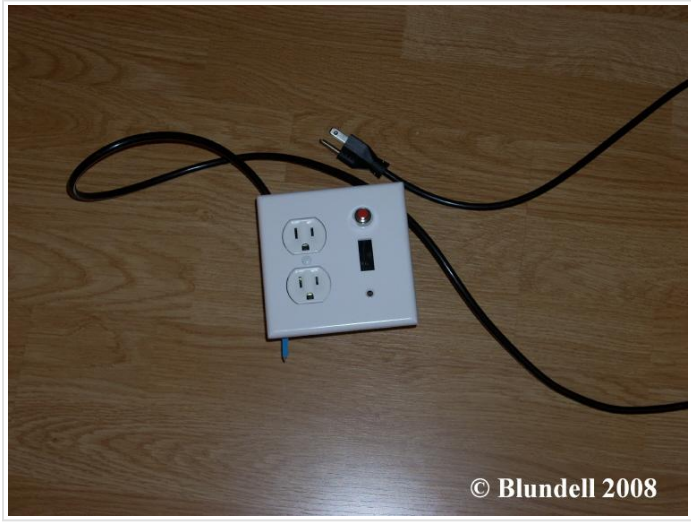
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ONLINE COURSES

# AQUARIUM PHOTOGRAPHY

## By D. Wade Lehmann

*Marine Aquarist Courses Online (MACO) is proud to offer, starting this fall, a two-stage course for aquarium photography.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): D. Wade Lehmann, Online Courses, Photography
Link to original article: http://www.advancedaquarist.com/2008/7/maco

Please visit the website for full details including dates and costs, as well as instructor bio and syllabus.

www.aquaristcourses.org

## AQUARIUM PHOTOGRAPHY TECHNIQUES

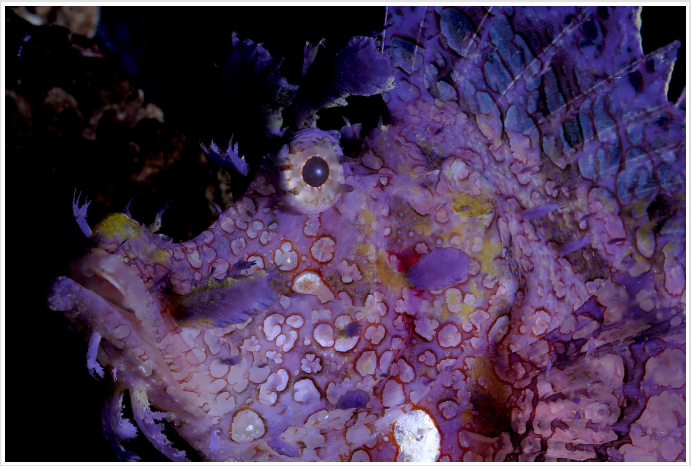
For registration, please see the following link: http://www.aquaristcourses.org/aqphoto/Aquarium%20Photography%20Techniques%20-%20Registration. This course begins September 14, 2008, register now!

### LEVEL I

Through interactive online learning with practical, hands on photography assignments and critiques of your images through your own student gallery on the MACO website, you will gain a thorough understanding of how to capture stunning photographs of marine or freshwater aquariums and their aquatic inhabitants.

During the Aquarium Photography Techniques - Level I course, you will learn how to utilize your camera equipment (including electronic flash) to capture clear & compelling images of aquariums under different conditions as well as the basic rules of composition and fundamental macro photography techniques.

We will examine how to 'set the stage' in an aquarium for your photo shoot while discussing a variety of techniques for capturing images of a variety of subject matter, including corals, invertebrates, and (of course) fish. We will also cover methods of photographing entire aquarium environments.



The Aquarium Photography Techniques - Level I course will also include an introduction to multimedia uses for your images & methods for displaying and sharing them as well as basic post-production skills, including digital file management and computer manipulation.

### Level II

In Aquarium Photography - Level II, utilizing similar interactive, online learning methods, we expand on many of the photographic skills and techniques learned in Level I. We will also learn about the use of some additional, specialized camera equipment and proceed to more specific and advanced techniques required to capture consistently stunning, or professional quality photographs of aquariums and their aquatic residents.

Throughout Level II, you will participate in additional hands-on photography assignments that will allow you to hone and practice your photography new skills. There will be regular critiques of your images through your own student gallery on the MACO website, which will help you to further improve your photography.

During Aquarium Photography Techniques - Level II, you will learn about…

- The use of specialized camera equipment and software for capturing unique, creative images of aquariums and their aquatic inhabitants
- Creating outstanding images through the effective use of visual design elements & imaginative composition
- Creative lighting techniques & specialized lighting equipment that will help you modify the quality of the light and improve your images
- More advanced digital Imaging techniques for enhancing your images and correcting problems you encounter while shooting
- Ways of successfully working with different & difficult subject matter & aquarium set-ups
- Ways you can use your photographs, including how to share and display them for your friends and also how to get your best images published and possibly make some money selling your photos (if you are so inclined)

MACO will also host the return of Fish Husbandry and Reef Chemistry courses! Please check the website for full details including dates and costs. www.aquaristcourses.org

Direct links to each course:

- Aquarium Photography I - http://www.aquaristcourses.org/aqphoto/
- Fish Husbandry - http://www.aquaristcourses.org/Fish%20Husbandry2/

## Aquarium Photography Course - Syllabus

### Week 1

#### Introduction

#### Camera Equipment

- Camera Bodies
- Lenses
- Macro Equipment
- Flash
- Tripods
- Filters

#### Computers for Photography

### Week 2

#### Creative Use of Camera Controls

- Shutter Speed
- Aperture / f-Stop
- ISO
- Color balance

#### Digital Imaging 1

- File formats
- File Preparation
- Resolution
- Cropping / Resizing

### Week 3

#### Light

- Reflections & their avoidance
- Lighting
- Electronic Flash

#### Aquarium Preparation

- Cleaning
- Aquascaping
- Photo-specific tanks

### Week 4

#### Composition

#### Digital Imaging 2

- Color Correction
- Exposure & Contrast
- Sharpening & Blurring
- Rubber Stamp & Heal

### Week 5

#### Aquatic Subject Matter

- Full Aquarium Photographs
- Aquatic Animal Portraits
- Macro & Close-ups

#### Introduction to Lighting Theory

### Week 6

#### Uses and Things to Do With Your Photos

- Multimedia & Internet
- Printing

#### Wrap-up

### Prerequisites

- Fundamental knowledge of basic photography
- Fundamental knowledge of computers & file management
- A basic knowledge of working with digital photos on your computer
- Thorough knowledge of the operation of your camera (familiarity with all buttons & modes)

### Student Equipment

If you are thinking about purchasing new camera equipment in the near future, please consider postponing your purchases until after our first class, as we will be discussing what to look for in camera equipment.

#### Required Gear

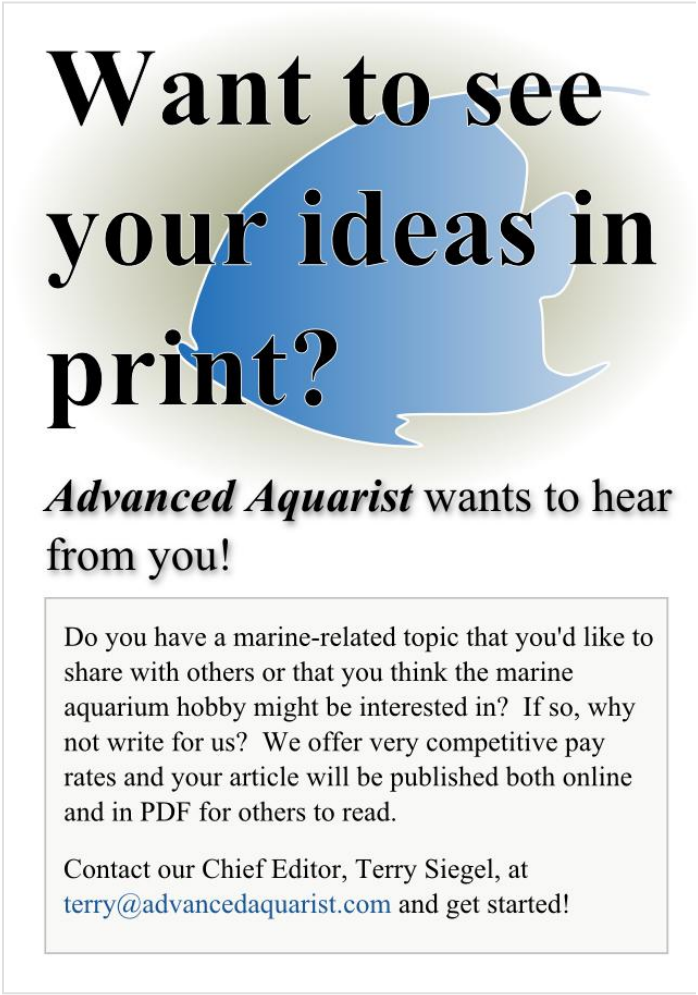
- Camera body (Much of the course content will be geared toward participants shooting with digital SLR cameras. However, the majority of course content will also be relevant to users of [highly functional] point-and-shoot cameras and those shooting with film.)
- Lens (Most quality, standard lenses will work for this course) (having a variety of focal lengths available will be beneficial)
- Computer (to deal with digital images) (will need sound card and speakers / headphones)
- Photo editing software (class materials will be based on 'Photoshop Elements' but any good photo editing program will likely do)
- Access to an (functioning) aquarium to photograph during the course

#### Recommended Gear

- Tripod (highly recommended)
- Flash (highly recommended-more than one is helpful)
- Additional lenses (A range of lenses / focal lengths from wide to tele-photo)
- Macro lens
- Scanner (if you are shooting film for class) (or access to a photo-finishing lab that will scan film for you)

## Fish Husbandry Course

MACO is also offering other courses, including a repeat of both the popular Fish Husbandry (http://www.aquaristcourses.org/Fish%20Husbandry2/). Please see the website for registration and full course details, including syllabus and instructor bio.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PRODUCT REVIEW

# Kill-A-Watt Electricity Meter And Suggestions to Reduce Power Consumption

By Dana Riddle

*This power-shaving game can get rather addictive once we're motivated by seeing our power utility bill drop month-by-month.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Keywords (AdvancedAquarist.com Search Enabled): Dana Riddle, Electricity, Equipment, Product Review
Link to original article: http://www.advancedaquarist.com/2008/7/short

I wonder how many times this conversion has occurred?

> *"Have you seen this month's power bill? It's outrageous! It's that @#*! reef tank of yours!"*

Probably more times than I can imagine.

Reef keeping has never been known to be particularly friendly to the bank account, though many of the original tanks weren't as power-hungry as those of today. It has been over two decades since the European style reef aquarium (the 'mini-reef') gained popularity in the North America. It might come as a surprise to those who weren't in the hobby at the time, but some of the earliest advisories from Europe advocated use of standard 40-watt fluorescent lamps, though use of metal halide lamps was considered mandatory for some coral species. And so it went. Standard fluorescent lamps gave way to very high output (VHO) fluorescent lamps, and a 'horsepower' race began with metal halides. By the late 1990's we were experimenting with microwave-driven sulfur lamps that produced at least 20,000 µmol·m²·sec (at least a magnitude greater than the brightest natural sunlight!). Hard core hobbyists - especially the SPS keepers - were trying 1,000 watt lamps over relatively small home aquaria.

Today, the pendulum is swinging the other way as we're realizing that we really don't have to blast captive corals with copious amounts of light. In fact, experienced hobbyists can often keep SPS coral alive and healthy while using - gasp! - Standard 40-watt fluorescent lamps. It seems as though we've come full circle.

Even with this realization, reef aquaria can be a major consumer of electrical power within a household.

With that said, this month's Product Review might not seem unusual. Although it doesn't involve a device that is specifically and directly aquarium-related, its importance should not be underrated since electrical costs are usually a significant portion of routine reef tank operational costs. This device, the Kill A Watt Electrical Usage Monitor, made by P3 International, is one that has the potential of saving you some of your hard-earned money. As a practical matter, use and prudent implementation of power-saving measures based on results obtained with the Kill A Watt meter could result in substantial savings. In the grand scheme of things, these savings combined with the possibility of reducing greenhouse gases is a win-win situation.

This device is relatively inexpensive and is certainly within the budget of most reef-keepers and fish clubs. It retails for about $30.00.

## Abilities of the Kill A Watt Meter - Terms and Definitions

P3's Kill A Watt meter can monitor these parameters:

- **Volt, (V)**: An internationally recognized unit of electromotive force. Volt is the strength or pressure of an electrical current, and the force that pushes electrical current through a wire. Household voltage is around 120.
- **Ampere or Amp, (A)**: A measure of electrical current or electron flow through a conductor. Amperage can be a good indicator of pump/motor condition.
- **Watt, (W)**: A measurement unit of power used to rate pumps, lamps, etc. This unit is also recognized internationally.
- **Kilowatt (kW)**: One thousand watts.
- **Kilowatt hour (kWh)**: A unit of work done by 1000 watts operating for 1 hour, or 250 watts for 4 hours, 100 watts for 10 hours, and so on. Power companies charge X number of cents per kilowatt-hour.
- **Hertz:** The frequency of alternating current (AC), normally 60 cycles per second, or 60 hertz. This is not in the control of the consumer.

## Useful Formulae:

- 1 horsepower = 746 watts, or 0.746 kilowatt.
- Watts = (Volts * Amps)

- Power Requirement = (Power, in kilowatts)*(Time, hours)

The particular model reviewed is P4400. It can measure Volts (up to 125 VAC), Amps (up to 15A), watts (maximum 1,875w - or a little over 2 horsepower, if we use the formula Watts/746= Hp). It an also monitor Frequency (in Hertz), Volt Amps (VA) and can calculate kilowatt-hours (kWh). Use of this meter is simple - plug the Kill A Watt monitor into a grounded outlet and then plug the appliance (powerhead, chiller, etc.) into the monitor. It accepts 2-prong and 3-prong grounded electrical plugs.

The Kill A Watt meter is for household use and is not intended for use with 'non-plug' electrical devices often used in industrial applications where high voltage is used in conjunction with relays and switches (use a multi-meter for that purpose, such as those made by Fluke™ and others).

## Instantaneous Measurements

The Kill A Watt meter can take instantaneous readings of wattage. This is a quick and easy way to confirm power draw by devices that never stop running (such as return pumps, powerheads, etc.). Total power consumption can be easily calculated using this formula: watts X 24 hours per day divided by 1,000 = kWh.

*Figure 1. P3's Kill-A-Watt meter. This device is relatively inexpensive.*

## Daily Power Consumption

Some devices cycle through on and off periods. Good examples of these items include refrigerators, window air conditioning units, chillers, heaters, powerheads controlled by wavemakers, etc. In these cases, it is best to use the Kill A Watt's kilowatt-hour feature. Simply plug the device into the meter, press the pink KWH button, and return 24-hours later for a display of total power consumption per day.

## Electrical Thieves

Electrical thieves are those items that even when turned off are in reality still drawing current. In reality, many items within our homes steal power merely for our convenience of avoiding 'warm up' time. Electrical thieves can include computer printers, back-up power supplies (UPS), televisions and many other devices. See Table one for a listing of power consumption by various devices.

Table 1: A quick glance of power consumption by various devices.

| Power Consumption of Various Devices | |
|---|---|
| **Item** | **Watts** |
| 13w CF Lamp | 10 |
| 40w Incandescent Lamp | 40 |
| 60w Incandescent Lamp | 58 |
| Television w/ Energy Star Rating (off) | 0 |
| Television w/ Energy Star Rating (on) | 52 |
| Television, old (off) | 5 |
| Television, old (on) | 59 |
| Refrigerator | 149 |
| DVD Player (on, standby) | 8 |
| Computer | 82 |
| Printer (on, standby) | 4 |

## Suggestions for Energy Savings

Although the Kill A Watt meter makes monitoring of power usage very easy, we don't necessarily need the device in order to put a major dent in our electrical bill.

Successful energy-reduction measures are more often a matter of small changes as opposed to 'hitting a home run'. These relatively minor things can be cumulative in nature and make a major difference in your monthly utility bills.

### Things You Can Do to Your Aquarium

- Consider lighting the aquarium at night when household temperatures tend to lower. *Insulate your aquarium's sides, back and bottom with sheets of styrofoam. Do the same to your sump.
- Insulate water lines running to and from your chiller.
- Consider a partial cover on the top of your sump to retain heat or cold.
- It isn't necessary to run a protein skimmer 24 hours a day. If possible, put the skimmer's pump on a timer and run it for perhaps 12 hours per day.

- Decrease the photoperiod. Ten or eleven hours per day is fine.
- LED lighting units are expensive but definitely have the potential to lower your energy bill, especially if you use a chiller, or air condition your fish room.
- Pay close attention to pump wattages. Some of the newer modification kits for powerheads are very good at reducing power consumption while greatly increasing water flow.

Of course there are many other things you can do to put a cap on your electrical consumption. Here are a few ideas for weekend projects that can begin to pay for themselves immediately:

## Electric Hot Water Heater

Generally, water heaters are the major consumer of non-aquaria related power consumption. Check the thermostat setting on the heater - it's usually set for 140°F (60°C). Turn it down to 120°F (~49°C). Install a timer on your electric water heater. Insulate the water heater with an insulation jacket. Insulate pipes carrying hot water (pipe insulation jackets are available in 4 foots lengths at most hardware stores and are quick and easy to install). Consider solar water heating (contact your local electricity provider for the possibility of an energy audit to see if this is feasible in your area).

## Replace Your Shower Head

Reduce your consumption of hot water by replacing your older shower head with a newer low-flow device. In a recent test, water-guzzling shower heads were exchanged for low-flow heads in an apartment complex, and not one person complained of the reduced flow!

## Refrigerator

When is the last time you checked your fridge's temperature? Generally, recommended temperature is 38°F to 40°F (~3°C to 4C°) for the refrigerated section and 0°F (-17°C) for the freezer. Use a refrigerator thermometer and check it weekly. Refrigerators/freezers require different settings in summer and winter. Refrigerator/freezer thermometers are available at most department stores for $5-$6.

Check the coils (usually on the back of a refrigerator) and clean them often for best heat exchange.

Keep the air passages clear in your refrigerator. A packed fridge can have poor airflow and prevent the thermostat from accurately controlling temperature (this is often noted when certain items freeze while others do not).

If your fridge is old, check the integrity of the door gaskets by placing a dollar bill on the gasket and then closing the door. Replace the gasket if the bill is not held in place or is easily pulled from between the gaskets.

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### Replacing Appliances

Look for the *Energy Star* rating when purchasing new appliances. If these aren't available, pay close attention to the energy efficiency ratings listed on the SEER rating on the yellow label. SEER stands for Seasonal Energy Efficiency Ratio. The higher the SEER rating, the more efficient the appliance.

### Clothes Washer

Run only full loads and use cold water or warm water settings whenever possible.

Insulate hot water lines running to the washer.

### Clothes Dryer

Older clothes dryers can be energy hogs. Run full loads for the minimum amount of time (you might be surprised how fast clothes can dry). Keep the lint trap clean. If you've got time, use a clothes line and let the sun dry your clothes.

### Dish Washer

Some dish washers offer an 'Energy Saver' option on the dial. This usually involves letting the dishes air dry. Run only full loads. Are the hot water lines insulated?

### Air Conditioners

Many of the newer window air conditioning units have an energy-saver setting. Use it. Make sure the aluminum heat exchanger fins are kept clean, as well as the air filters. Central (whole-house) AC units' heat exchanger fins should also be washed periodically using a water spray nozzle.

### Replace Those Incandescent Lamps!

Incandescent lamps are almost history - if you use them for interior lighting, replace them now with the small spiral compact fluorescent lamps. These use much less energy and don't operate at high temperatures, thus lightening the load on your air conditioner.

### Adopt a Lights-Off Policy

Many of us will turn a light on and leave it on even if we don't need it. The same goes for TVs. Get in the habit of turning lights and appliances off when not needed.

### Doors and Windows

These temporary openings in our homes should be just that and not allow permanent openings - even tiny ones - for heat/cooling losses! Make sure your windows are caulked and insulation strips around doors are in good shape. Consider installing storm doors and storm windows for added insulation.

### Tint Your Windows

Some of the newer window-tinting films have surfaces that reflect infrared radiation. In addition, these often block ultraviolet radiation that can cause furniture and carpeting to fade. Window tinting is especially desirable in areas with warmer climates.

### Insulation

This one is a no-brainer. Make sure you've got adequate insulation in the attic and crawl space. If insulating the attic is a DIY job, make sure you don't cover any vents that allow air circulation.

### Plant a Tree or Two

If you live in a warm environment, consider planting a tree or two in a strategic spots around your house. The shade keeps a portion of your house exterior cool, and the tree can absorb up to 25 pounds of carbon dioxide a year.

## In Closing

The Big Island of Hawaii has some of the highest electricity costs in the nation, due to it being produced by diesel-powered generators. With costs approaching 40 cents per kilowatt-hour, I was forced to do everything I could to conserve energy. This included many of the items listed above, and I am glad to say that I've seen the power bill drop over 33% even while generation and consumer costs are rising.

This power-shaving game can get rather addictive once we're motivated by seeing our power utility bill drop month-by-month.

Has the irony escaped everyone that our keeping of artificial reefs may be contributing, even if in a small way, to the destruction of natural reefs? As responsible stewards of the environment, we really should try to conserve. No matter what your motivation - concerns about global warming, lessening dependency on foreign oil supplies, budgetary reasons - conservation pays.

ONLINE NEWS

# Reefs in the News

## From Online News Sources

*Media coverage of the state of our world's reefs, interesting information, and other marine-related news.*

Published July 2008, Advanced Aquarist's Online Magazine.

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Link to original article: http://www.advancedaquarist.com/marinenews

### NOAA Announces Funding to Support Ocean Observing in Southern California

NOAA News Releases
July 31, 2008 02:51 PM

NOAA is awarding $853,785 to support ocean observing efforts in Southern California. The fiscal year 2008 funding is provided through NOAA's Integrated Ocean Observing System (IOOS) program.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080731_oceanobserving.html

### Reef Contest for Kids (KHNL News 8 Honolulu)

Yahoo! Coral Reefs News
July 31, 2008 03:28 AM

HONOLULU, Hawaii (KHNL) - The ocean is very important to the people of Hawaii, and students from across the country are invited to show off their knowledge about marine conservation. The Hawaii Ocean Guardian's Kid's Club is part of the 2008 International Year of the Reef observance in Hawaii.

Read More...

Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11iq8frtn/*http%3A//www.khnl.com/Global/story.asp?S=8764341

### Nature and science thrive under one living roof in California (USA Today)

Yahoo! Coral Reefs News
July 31, 2008 01:21 AM

After four years of renovations, the California Academy of Sciences reopens with cooler exhibits and a greener mentality.

Read More...

Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=12iiij5dh/*http%3A//www.usatoday.com/news/nation/2008-07-30-california-academy_N.htm?csp=34

### NOAA Announces Funding to Support Marine Observing in the Great Lakes

NOAA News Releases
July 30, 2008 09:49 PM

NOAA is awarding $750,000 to support marine observing efforts in the Great Lakes region. The fiscal year 2008 funding is provided through NOAA's Integrated Ocean Observing System (IOOS) program.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080730_greatlakes.html

### Summer 2008 Marked by Deadly Rip Currents

NOAA Government News Releases
July 30, 2008 06:07 PM

Each year, about a hundred people drown in rip currents. NOAA offers valuable advice to help you avoid and/or survive a rip current.

Read More...

Source:
http://www.ripcurrents.noaa.gov/tips.shtml

### Oceanic Acidification - The Scenario In 100 Years' Time (Environmental News Network)

National Marine Sanctuary in the News
July 30, 2008 01:20 PM

A new study by scientists into the future effects of acidic sea water shows that the reduced pH value of the oceans' surface waters will have drastic results in around 100 years' time. The scientists, from Sweden and Australia, carried out the world's first research into how a lowered pH of the sea's surface water affects marine animal life. In their project, they allowed sea urchins of the ...

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11f676qeb/*http%3A//www.enn.com/ecosystems/article/37799

## Roz Savage Continues Her Quest to Become First Woman to Row Solo Across the Pacific Ocean (PR Newswire via Yahoo! Finance)

National Marine Sanctuary in the News
July 30, 2008 12:22 PM

At midnight on May 25, 2008, beneath the Golden Gate Bridge, Roz Savage took her first strokes aboard a 24-foot rowboat named The Brocade, after title sponsor Brocade Communications Systems, Inc.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=110mf4n4h/*http%3A//biz.yahoo.com/prnews/080730/aqw526.html?.v=19

## Report-Supertanker damaged coral reefs (The Nassau Guardian)

Yahoo! Coral Reefs News
July 30, 2008 08:38 AM

An underwater environmental assessment report, which was released yesterday from the Ministry of Environment, has revealed that the Shell F-class supertanker "The Ficus" - which struck a reef and ran aground earlier this year - left some coral reefs either dead or damaged and caused scarring to the sea floor.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=127nqvpi6/*http%3A//www.thenassauguardian.net/national_local/303008330514406.php

## Report: Offshore Aquaculture Would Benefit U.S. Economy

NOAA News Releases
July 29, 2008 03:18 PM

Aquaculture shows significant economic potential and good prospects for success in the United States, according to a new report commissioned by NOAA. The report's authors call for clear rules to be enacted to guide the development of an offshore aquaculture industry.

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Source:
http://www.noaanews.noaa.gov/stories2008/20080729_aquaculture.html

## NOAA Offers Reward for Information on Sea Turtle Poaching

NOAA News Releases
July 29, 2008 03:17 PM

NOAA's Fisheries Service Office of Law Enforcement is offering up to $1,000 for information leading to the arrest and/or conviction of persons poaching endangered sea turtles in the Territory of Guam and in the Commonwealth of Northern Marianas Islands.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080729_seaturtle.html

## Study: High CO2 environment damages reefs (Moldova.org)

Yahoo! Coral Reefs News
July 29, 2008 01:54 AM

Reefs may erode in areas with high carbon dioxide levels because the glue binding coral skeletons to larger reef structures is missing, a U.S. study found.The study found coral reefs in the eastern tropical Pacific Ocean offer a real-world example of the what reef ecosystems will face under high carbon dioxide conditions resulting in ocean acidification, the National Oceanic and Atmospheric ...

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11bff012i/*http%3A//it.moldova.org/stiri/eng/138087/

## Survey Cruise Records Second-Largest "Dead Zone" in Gulf of Mexico Since Measurements Began in 1985

NOAA News Releases
July 28, 2008 07:36 PM

NOAA-supported scientists from the Louisiana Universities Marine Consortium found the size of this year's Gulf of Mexico dead zone to be 7,988 square miles, slightly smaller than the predicted record size of 8,800 square miles and similar to the area measured in 2007. Scientists think Hurricane Dolly's wind and waves may have added oxygen to the zone to reduce its size.

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Source:
http://www.noaanews.noaa.gov/stories2008/20080728_deadzone.html

## Report: Number of Blue Crabs in Bay Remains Below Long-Term Average

NOAA News Releases
July 28, 2008 04:27 PM

The Chesapeake Bay's blue crab population remained below the long-term average in 2007, according to a report approved by the NOAA-chaired Fisheries Steering Committee.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080728_bluecrab.html

## Special lobster season set for Wednesday, Thursday (Naples Daily News)

National Marine Sanctuary in the News
July 28, 2008 01:51 PM

Recreational and commercial harvest seasons for spiny lobster in Florida are set to reopen soon. The special two-day spiny lobster sport season comes first, on July 30 and 31 this year, followed by the regular lobster season, which begins on Aug. 6 and extends through March 31.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=13hidc3tj/*http%3A//naplesnews.com/news/2008/jul/28/special-lobster-season-set-wednesday-thursday/?partner=yahoo_headlines

## Hurricane Dolly Offers Silver Lining To Some Drought Stricken Texas Counties

NOAA Government News Releases
July 28, 2008 12:04 PM

The remnants of Hurricane Dolly have provided a mixed bag of damaging floods and welcome drought relief for residents of south Texas.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080725_drought.html

## Geologist hunts for lake secrets (The Oakland Press)

National Marine Sanctuary in the News
July 28, 2008 10:03 AM

John Zawiskie is using his summer vacation to go back to school. Zawiskie, a geologist at the Cranbrook Institute of Science, is doing research on Thunder Bay Island in Lake Huron east of Alpena along with Rick Rochte, a geologist at Wayne State University.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=127p96nk6/*http%3A//www.theoaklandpress.com/stories/072808/loc_20080728200.shtml

## Report stumps for shark protection (Florida Today)

Yahoo! Coral Reefs News
July 28, 2008 06:35 AM

They wolf down the weak, the sick and smaller predators. Without big sharks, the mix of fish could shift along coral reefs and sea-grass beds and devastate economically important industries for clams and oysters, a new report by Oceana says.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=12kv7edct/*http%3A//www.floridatoday.com/apps/pbcs.dll/article?AID=/20080728/NEWS01/807280320

## A whale of a trip (Cape Cod Times)

National Marine Sanctuary in the News
July 28, 2008 06:08 AM

A single mother who's lived on the Cape for nine years, Monteiro has always wanted to go whale-watching with her son. "It's such a Cape Cod thing to do," she said.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12jrivjc2/*http%3A//www.capecodonline.com/apps/pbcs.dll/article?AID=/20080728/LIFE/807280301

## Activist fires shots off bows for reefs (The Palm Beach Post)

Yahoo! Coral Reefs News
July 27, 2008 07:10 PM

Several weeks after Gov. Charlie Crist signed the bill banning ocean sewage dumping and handed him the pen, Palm Beach County Reef Rescue director Ed Tichenor took a little more time off from his window treatment business to launch a new quest.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=130mm3vvv/*http%3A//www.palmbeachpost.com/news/content/local_news/epaper/2008/07/27/0727tichenor.html?cxtype=rss&cxsvc=7&cxcat=76

## Lobster downturn brings minimystery (Miami Herald)

National Marine Sanctuary in the News
July 27, 2008 07:41 AM

The last week of July means two things in Florida: the increased threat of hurricanes and a sharp spike in work absenteeism on Wednesday and Thursday.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=120gaqhmg/*http%3A//www.miamiherald.com/sports/outdoors/story/619288.html

## Crabs more susceptible in larvae stage (The Garden Island)

National Marine Sanctuary in the News
July 27, 2008 07:34 AM

The mass deaths of hundreds of tiny crabs discovered at Po'ipu Beach Park and areas around the park may have an explanation.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11ttp2h4e/*http%3A//kauaiworld.com/articles/2008/07/26/news/news06.txt

## Taiwan accuses Chinese fishermen of wrecking coral reefs (AFP via Yahoo! News)

Yahoo! Coral Reefs News
July 27, 2008 06:00 AM

Chinese fishermen have been accused of poaching in Taiwan's first marine national park where authorities here say their destructive methods are endangering the area's ecology.

Read More...

Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=1374qr642/*http%3A//news.yahoo.com/s/afp/20080727/sc_afp/taiwanenvironmentconservationchinahongkong_080727060040

## Sunken German U-boats mapped off North Carolina coast (Kinston Free Press)

National Marine Sanctuary in the News
July 27, 2008 04:04 AM

Epic maritime battles between Nazi Germany and Allied forces during World War II seldom ended without bloodshed. German U-boats often patrolled off the U.S. Atlantic coastline hoping to send a vessel to its early demise with one torpedo strike.

Read More...

Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12j2pligf/*http%3A//www.kinston.com/news/wreckage_48463___article.html/expedition_first.html

## Coral-killing starfish curbed by fishing ban (New Scientist)

Yahoo! Coral Reefs News
July 26, 2008 10:34 AM

Crown-of-thorns starfish, which can devastate coral reefs, are less common in Australian no-fishing zones

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=14e9t9pjn/*http%3A//environment.newscientist.com/channel/earth/mg19926663.400-coralkilling-starfish-curbed-by-fishing-ban.html?feedId=online-news_rss20

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## AquaCave

At AquaCave, we offer a large selection of aquarium supplies for both, freshwater and saltwater enthusiasts. The prices and quality of our aquarium equipment keep our customers coming back. We stock thousands of aquarium supplies such as protein skimmers, air pumps, water pumps and power heads, full line of $CO_2$ equipment, calcium reactors, aquarium lighting, fish food, refugiums, aquarium filters, heaters, and much more. New items are added daily so please visit us often to get the latest high quality products at great prices.

## HelloLights

HelloLights has been in business since 1997 providing the aquarium industry with high quality lighting products and accessories. Throughout the years, our mission has been to be the aquarium hobbyist? one stop source for all of their lighting needs. With unsurpassed customer service and high quality products, we truly believe we are the clear choice for aquarium lighting. We realize that lighting is one of the major purchases that the hobbyist will make when setting up an aquarium, and we take great pride in our role in this process.

## Marine Depot

MarineDepot.com is the current leader in supplying marine and reef aquarium supplies. We simply try to make as many people (including both our staff and our customers) as happy as possible. We found that we have been able to accomplish this by maintaining extremely low prices, providing friendly customer service, and simply liking what we do.

## Premium Aquatics

Premium Aquatics is a family owned and operated aquarium business. We have been in business since April 1996 and we are dedicated to serving the aquarium hobbyist. Our mission is to bring you the highest quality aquarium products and livestock available and at a reasonable price and to provide honest non-bias information on all of our products and our competitors. Our goal is customer satisfaction, we want your return business.

## Salty Supply

Our goal is to provide only the best aquarium supplies available and to promote successful and responsible husbandry for all of our aquarium animals. We stock hundreds of the best aquarium and reef supplies and constantly growing. Some of which include, protein skimmers, chillers, calcium reactors, reverse osmosis systems and replacement filters and we specialize in reef tank lighting. We are adding to our inventory daily so be sure to visit us often.

# Two Part Solution

The Two Part Solution is a method of adding calcium, alkalinity and magnesium to your reef aquarium. What's unique about this solution is many of the items used are household items or just bulk supplies of the very same products you are buying two cups of for $20 just because it has a fancy package. It has been time tested by thousands of aquarists and proven to not only be incredibly effective and easy to use but also extremely affordable. There is simply no other balanced calcium, alkalinity and magnesium solution out there that is so ridiculously cheap and has no expensive and intimidating equipment to buy.

## Deltec USA

Deltec aquarium equipment is renowned throughout the world for its high performance and superior quality. Deltec has been in the marine aquarium business for more than 20 years in Europe, and developed the pinwheel more than 19 years ago.

## Global Aquarium Supply

We are your one stop source for all your Salt Water Aquarium needs! We carry Aquariums, acrylic aquariums, Hamilton Lighting, Metal Halide lighting, Power Compacts, Protein Skimmers, ASM Skimmers, Euroreef skimmers, AquaC Skimmers, Iwaki pumps, Eheim Pumps, Rio pumps, MagDrive pumps, SeaSwirl, AquaUltraviolet, UV Sterilizers, Salifert test kits, CPR Filters, Calcium reactors and more.

## J&L Aquatics

Quality Aquarium supplies, equipment, and livestock at reasonable prices. J&L Aquatics was formed in December 1997. Our business was started from our love of the aquarium hobby. We at J&L Aquatics felt that the Canadian aquarist should have the option to purchase top quality supplies, equipment and livestock other than the generally over priced local retail stores. With this philosophy in mind we have successfully operated and grown our business for the past five years.

## Marine Garden

We started almost a decade ago on a small place in south Florida now, over the years Marine Garden not only have grown but had developed new techniques on keeping corals and Fishes as healthiest as if they were on the Ocean. Most of our corals are 100% captive grown by ourselves or other Professional hobbyists. By purchasing aqua cultured corals, since they use to be in captivity you are getting not only the best quality but also a stronger and harder specimen. Also, you will be helping to minimize the problem of the declining coral reefs in our oceans

## Reef Nutrition

Reef Nutrition Marine Live Feeds are produced by Reed Mariculture, the world's largest producer of marine microalgae concentrates. We supply algal feeds and zooplankton to universities, marine ornamental growers, and over 500 fish, shrimp, and shellfish hatcheries in 70+ countries around the world.

## Southern California Caulerpa Action Team

An important goal of the Southern California Caulerpa Action Team is the detection of undiscovered infestations of C. taxifolia or other invasive species of Caulerpa, and the prevention of their spread.

## Sunlight Supply, Inc.

Sunlight Supply Inc. is a manufacturer and importer of High Intensity Discharge (H.I.D.) and fluorescent lighting fixtures. We specialize in fixtures with applications in the hobby & commercial horticulture and reef tank aquarium industries. Sunlight Supply Inc. is a recognized and respected leading brand in the marketplace.

## That Fish Place

We are the original Aquatic and Pet Supply Superstore! Every year, tens of thousands of visitors come from all over the US and Canada to explore our 110,000 square foot retail store. Bring your pet along and check out our incomparable fish room with over 800 aquariums!

### Alti's Reef

Farm raised frags and drygoods.

### AquaCave, Inc.

At AquaCave, we offer a large selection of aquarium supplies for both, freshwater and saltwater enthusiasts. The prices and quality of our aquarium equipment keep our customers coming back.

### AquaFX

The Leaders in Aquarium Water Treatment and Purification.

### Aquaripure

An aquarium setup to reduce aquarium maintenance, nitrates, and improve water quality for all fish tanks.

### AquariumPart.com

AquariumPart.com is an online retailer of many hard to find parts for various aquarium lights, pumps, protein skimmers, meters, UV sterilizers and filters.

### Champion Lighting & Supply

USA's largest distributor of exclusively Saltwater products.

### EcoSystem Aquarium

Through extensive experiments since 1987, EcoSystem Aquarium proudly brings only time tested and proven products to the Aquatic Industry.

### E.S.V. Company, Inc.

Specialty Chemicals and Products for the Advanced Aquarist.

### Jelliquarium

Specializes in custom made aquariums for jellyfish.

### Microcosm

Microcosm™ Aquarium Explorer is the creation of an international team of leading aquarium authors, marine biologists, underwater photographers, and tropical naturalists.

### Phishy Business

Phishy Business is a reef livestock mail order company dedicated to captive propagation of soft and SPS corals.

### Red Sea

A leader in the development and introduction of new and innovative technologies and products for the serious aquarium hobbyist.

### Salty Critter

Your source for saltwater and reef aquarium supplies and equipment here online, or come visit us at our full service walk-in retail location.

### Tropical Fish Auction

Buy and sell aquarium fish, invertebrates, coral, aquarium supplies, and more!

### Two Little Fishes

Products and Information for Reef Aquariums and Water Gardens.

reefs.org
WHERE REEFKEEPING BEGINS ON THE INTERNET

"www.reefs.org - If you had to pick a "one-stop shop" for everything online for reefs, this would be it. If you can't find it here, you can't find it." – Richard Sexton, Tropical Fish Hobbyist, November, 2002

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